# AMERICAN MACHINIST

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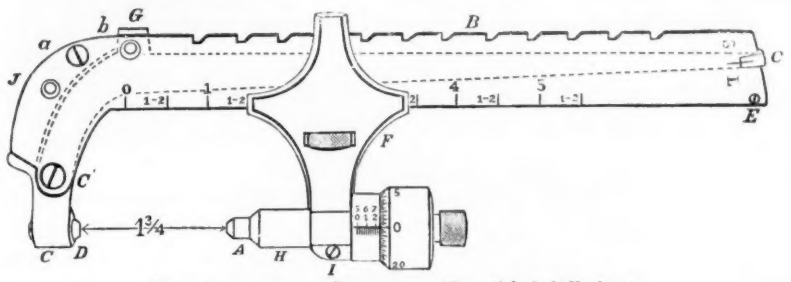
## New Indicating Caliper.

In using solid gauges for the production of pieces of work of equal sizes, difficulties are experienced where such pieces are slightly over size so that they will not enter the gauge. On the other hand, the pieces of work are sometimes made under size, so that they will too easily pass through the gauge.

There is a certain margin that is admissible both above and below size, without seriously interfering with the standard. The problem to be solved is, how best to ascertain precisely how much above or below size a piece of work may safely be. To alter the gauge when once set would be a loss of time, and if the gauge be solid this cannot be done. If the gauge be a micrometer caliper, it would be a very slow and objectionable operation to change the screw every time a piece of work is found that does not agree with the gauge. In the inspection of large quantities of small pieces, such as sewing machine parts and gun work, when they are of the right size it requires unnecessary time to pass them through between the surfaces of the gauge, but more particularly if the pieces undergoing inspection be slightly over size, as is often the case owing to the wear of gauges.

To overcome the foregoing objections it has become necessary to devise a gauge in which the distance between the gauge contact surfaces shall be enlarged, temporarily, to admit the pieces of work, then be allowed to close upon them. This method has been used in measuring parts of watches and clocks for many years, but until now, so far as we know, no such gauge has been manufactured for measuring the different parts of machinery, and for general use in machine shops.

Such an instrument is shown in the accompanying engraving. It is the invention of M. M. Barnes, and is being introduced by A. J. Wilkinson & Co., 184 and 188 Washington Street, Boston, Mass. This gauge consists of a steel beam *B*, to one end of which an indicator arm *C*, *C*, is attached, as is shown by the dotted lines. This indicating arm has a fulcrum pivoted to the beam at *C'*. The short arm of this lever is one-twelfth the length of the long arm, so that any variation in a piece of work from the standard size will be multiplied twelve times at *S*, *L*. At this point it will be observed that the end of the indicating arm is turned over and appears above the beam *B*, so that when the pieces of work tested are of the exact size, the mark upon the end of the indicating arm and the one upon the beam *B*, will exactly coincide.




NEW INDICATING CALIPER.—(One-third full size.)

If the piece be long, or large in diameter, the indicating arm will incline towards *L*, but if it be shorter, or smaller in diameter, the arm will incline towards *S*.

The slide *F*, carries the micrometer screw with its graduated collar. The threads upon the screw are forty to the inch, so that one entire revolution will cause a longitudinal movement of $\frac{25}{1000}$ or $\frac{1}{40}$ inch. The collar is graduated into one hundred equal parts, each of which represents a longitudinal movement of the screw of *one quarter thousandth of an inch*. These graduations are about $\frac{1}{32}$ of an inch apart, so that they may be read without difficulty.

It will be observed that the threads of the screw are entirely enclosed, a feature peculiar to this instrument. This is effected by a sleeve *H*, which is screwed fast to the slide *F*, through which the plain end of the screw *A* operates. By this device it is impossible for dirt or emery to get into the threads, neither is the oil likely to be wiped off, leaving the screw dry so that the surfaces will abrade and stick fast. On the contrary, the screw is always well lubricated, which is a very important feature in all measuring instruments.

When desired, the micrometer can be set to any size, and used as a solid gauge, by tightening the screw *I*, then taking the screw *a* out and placing it in the hole *b*. This screw passes through the indicating arm *C* and prevents it from moving, therefore the gauge surfaces *A* and *D* remain fixed. The screws *a* and *C'* are of steel, conical shaped, hardened and ground to a fit.

In using the indicating arm the screw always remains in the hole *a*.

When a piece of work is to be tested, the instrument is to be taken in the left hand, pressing upon the thumb piece or stop *G* of the indicating arm. This increases the distance between the points *A*, *D*, admitting the piece of work between them. The thumb is then removed, allowing the gauge surfaces to close upon the piece to be tested, and the position of the end of the indicating arm noted at *S*, *L*, which will indicate any error, as already described.

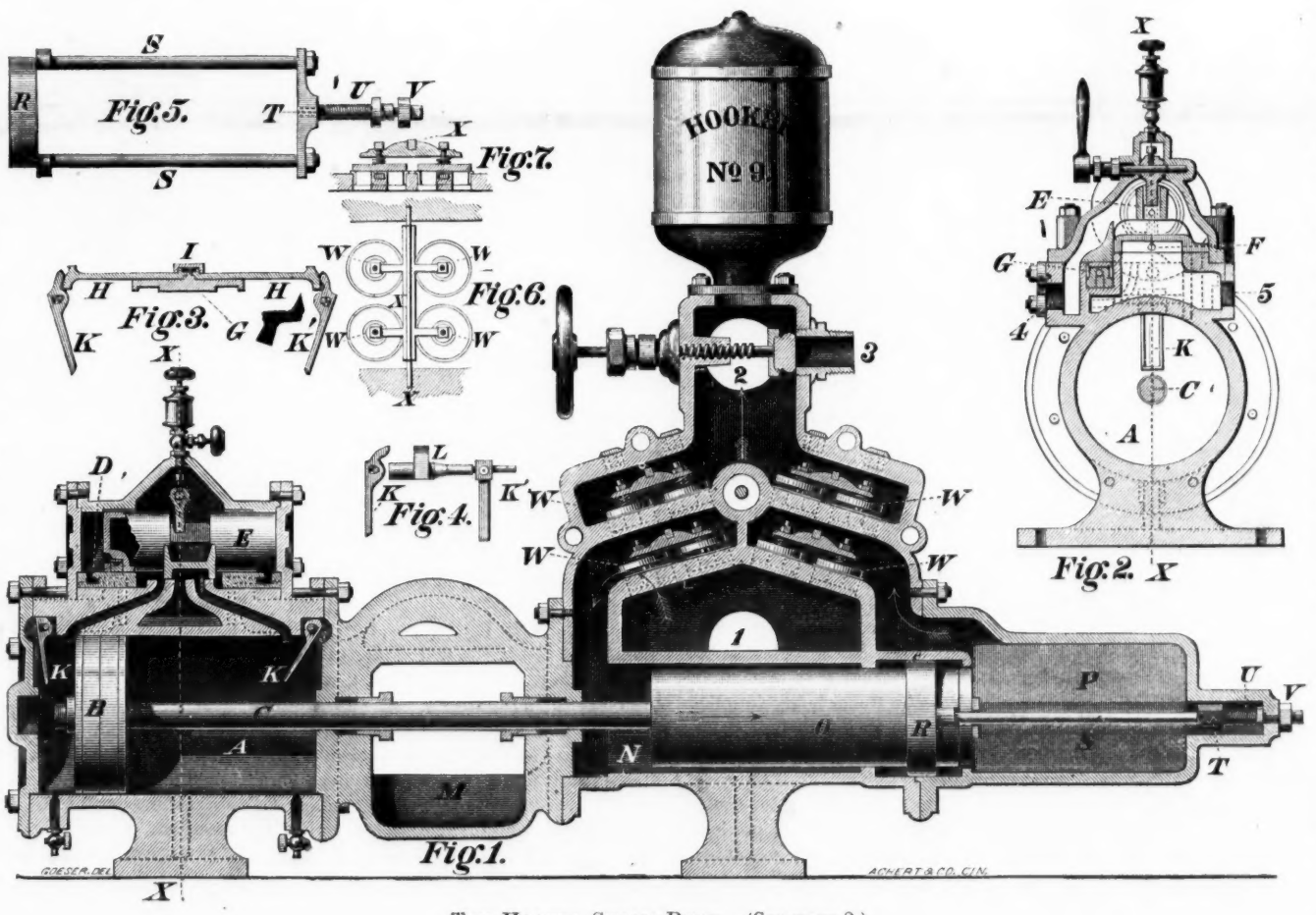
As the gauge surfaces wear, their positions may be rectified by turning the screw *D*. The notches in one edge of the beam *B* are placed half an inch apart, while the graduations are marked upon the opposite edge. It will be noticed that one side of the notches, towards *G* is straight, as this side is depended upon for the precise adjustment of the slide *F*. The locking device is, therefore, straight upon one side, while it is beveled upon the opposite side. The latch does not bottom in the notch, so that it may be relied upon for bringing the slide *F* to the same position every time. Should a particle of dirt accidentally lodge upon the beveled side of the notch, it will not affect in the slightest degree the accuracy of the adjustment.

The slide *F*, when closed to zero or the notch nearest *G*, and the micrometer made to read $\frac{500}{1000}$, will bring the gauge surfaces *A*, *D*, in precisely the same position as when the slide *F* is placed at the second or half inch notch, and the micrometer placed at zero. In such case, the measurement is $\frac{500}{1000}$; then, by turning the screw, we read $\frac{600}{1000}$, and so on, to one inch, as illustrated by the figures on the micrometer.

The highest limit of this instrument is 6″, but the micrometer is made to measure $\frac{45}{1000}$ inch above 6″; also $\frac{45}{1000}$ inch below zero. This arrangement is adapted for various measurements, and is, we believe, peculiar to this instrument.

The slide *F* is prevented from slipping off the beam by the stop *E*, which also forms a stop for the end of the indicating arm. For inspecting large quantities of work, a little bracket or post, furnished with the instrument, is screwed fast to the bench, holding the instrument securely at *J*, with the end *E* towards the light, in which position the instrument may be very rapidly manipulated.

The view here shown is one-third full size. The instrument is well made, and is put up in a velvet-lined case, and may be carried in the pocket. They are made in various sizes, and graduated either to the English or metric systems. The largest sizes are of special design, being adapted for use in railroad, marine and stationary engine shops.




THE HOOKER STEAM PUMP.—(See page 2.)

### The Hooker Direct-Acting Steam Pump.

The engraving presented on page 1, is that of the Hooker direct-acting pumping engine, as made by the Hooker-Colville Steam Pump Company, 823 North Second Street, St. Louis, Mo. It consists of a steam cylinder *A*, Fig. 1, and a water cylinder *N*, joined together by a yoke *M*, cast solid with the two cylinder heads, as shown. The steam piston *B* is 12″ in diameter, being connected with the pump plunger *O*, 7″ in diameter, by the piston rod *C*, which may be of brass or iron as desired. The piston has a stroke of 16″ and is packed with metallic rings in the usual way, while the packing for the plunger is adjusted by pressing the gland or ring *R* against it by the adjusting screw *U*. When a final adjustment is made, the screw *U* may be permanently held by the lock nut *V*. The two parallel rods *SS* are connected by a connecting bar or strap, which is more plainly shown in Fig. 5, where it will be observed that the adjusting screw *U* is placed in the center so that the rods *SS* press equally upon each side of the ring, *R*. To inspect or repack the plunger, access may be readily obtained by removing the plunger bonnet *P*, shown in Fig. 1. The plunger packing can be set up while the pump is running without interfering with the action of the pump. After the plunger becomes worn it can be quickly trued up so that it is as good as new. This operation does not necessitate a renewal of any other parts of the pump. The pump cylinder together with the valve chests are cast in one piece. The valves *WW*, *WW*, are arranged so that they may be reached by simply removing a cover held in place by T head bolts and occupies but a few moments' time.

The construction of these valves is more clearly shown in Figs. 6 and 7, the former representing a plan and the latter a section through the center of two of the valves. These valves are round discs, and having no bolts or nuts are kept in place by valve rods *X*, and guides of special design. The valves may be removed for inspection or replaced when worn out in a few moments' time.

The inlet or suction pipe 1 of the pump being above the barrel, the cylinder *N* always remains full of water. 2 is the discharge, and 3 a hose connection controlled by a valve. This pump has a drain valve, to be used to prevent freezing up. It also has a relief valve to regulate the pressure. Steam is admitted to and from the cylinder *A* by a main slide valve *F*, shown in Fig. 2, and is operated by the piston valve or supplemental piston *E*. Steam is admitted to the valve chamber *D*, and is exhausted through the medium of the supplemental valve *G*. The piston in traveling from end to end of the cylinder *A*, comes in contact with the rocker arms *K*, *K*. These arms are attached to rocker shafts *L*, as shown in Fig. 4. In Fig. 3 is shown the supplemental valve motion, in which the supplemental valve is shown at *G*. From the cap *I* the valve rods *H H* extend each way, so as to be in constant contact with the toes connected with the rock arms *K*, *K*.

With this valve motion a full stroke of the piston is insured, as the valve cannot move until the piston has completed its stroke.

It will be observed that in these engravings like numbers refer to like parts, so that the details alluded to may be readily understood. In Fig. 2, 4 represents the steam pipe and 5 the exhaust. The position of the supplemental valve *G* is readily comprehended from this engraving. All the ports are cored out and none drilled, and hence are not liable to be clogged with dirt. The steam from the valve chamber is alternately supplied to and exhausted from the ends of the supplemental piston through one and the same port. All the ports are short, and as direct as possible.

By a steam cushion, shock and pounding are prevented in running at high speed. The supplemental piston is cushioned by a small valve at each end, as shown in Fig. 1. These valves are simply small, loose valves of the same shape and section as the supplemental piston working in each end of it; the tightness of the supplemental piston is, therefore, not depended upon to prevent leakage. By removing the valve chamber of this engine, the main, as well as the supplemental valves can be inspected and repaired, if necessary. Being of the ordinary flat style, they are easily faced.

The steam, on being admitted to the center of the valve chamber, will bring its pressure to bear on the main and supplemental valves *F* and *G*, and also within the recess in the center of the supplemental piston *E*. This recess encloses the main valve *F*, so that the main valve is caused to move with the supplemental piston whenever the steam is supplied to and exhausted from each end of this piston. The live steam now passes through the left-hand port, driving the main piston *B* to the right, the exhaust passing out through the right-hand port and under the flat slide valve *F* to the atmosphere. As the main piston nears the right hand exhaust port, it comes in contact with the arm *K*, which, being fastened to the rockshaft *L*, causes the rockshaft to oscillate.

By means of the cam-shaped arm on it in the valve chamber, it moves the supplemental valve to the left, thus supplying live steam to the right of the supplemental piston, and exhausting it from the left; and as this supplemental piston encloses the main valve, this valve is carried with it to the left. Steam now enters the right-hand port, and is exhausted from the left-hand port, the engine commencing its return stroke, and the operation before described becoming continuous. As the main piston closes the exhaust to the right, it is arrested on compressed exhaust steam, the main valve having closed the auxiliary port (unseen) leading to this end of the main cylinder—the steam being supplied through both the main and auxiliary ports, but released through the main port only.

This slowing of the movement of the main piston at the termination of its stroke causes the pump valves to seat quietly, all noise or compression in the pump being prevented, and insures a steady pressure upon the water column. The compression also fills up the space between the main piston and the cylinderheads with compressed exhaust steam, no live steam being wasted to fill this clearance.

The rockshafts *L* are tapered and ground to fit their seats in the valve chamber, the steam pressure holding them firmly to their seats. There can be no leakage of steam from the valve chamber to the main cylinder, nor are any stuffing boxes required. It is simple in construction, and an ordinary mechanic can keep it in repair.

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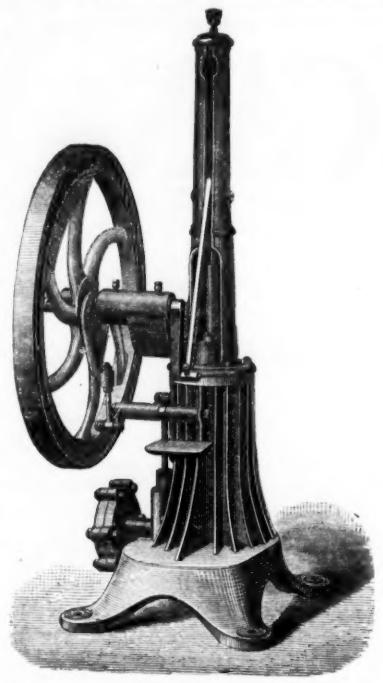


### The Sombart Gas Engine.

The engraving herewith presented represents one of the sizes of small gas engines, first constructed in Germany, and now being brought out by the Sombart Gas Engine Co., of 215 Centre street, New York. The intention in bringing out this engine is to meet the demand for a cheap engine of small power, the sizes made being from $2\frac{1}{2}'' \times 6''$, or $\frac{1}{8}$ horse power, up to and including $8'' \times 20''$, or 2 horse power. It will be seen that the engine consists of an upright column, with a suitable base, within and upon which the operating parts are located.

The cylinder is in the lower part of the column, the piston rod extending to a crosshead working in the upper part, which is bored out for the purpose. From the crosshead the connecting rod extends downwards to the pin of the solid cast steel overhung crank. The crank shaft runs in a long bushed bearing. Deep ribs are cast on the outside of the column against the cylinder. These ribs are for the purpose of affording a large amount of radiating surface, no other means being employed for cooling the cylinder.

Into the bottom of the cylinder the air and gas, in the proper proportions to form the explosive mixture, are admitted from the beginning of the upward stroke, and until the piston has uncovered the ignition valve, when the flame from the ignition jet is drawn in, igniting the mixture and bringing about the explosion. The force of the explosion closes the ignition valve, and the stroke is completed by the expansion of the exploded mixture and the momentum of the fly-wheel. As the piston descends, the products of the explosion escape through the exhaust pipe.

The valve is of the equilibrium piston type, and driven by an eccentric, through a rock shaft. The casting in which this valve works is a piece separate from the cylinder, so as to be removed for repairs or renewal if necessary.

The igniter is located at the back of the cylinder, and consists of the usual gas and relighting jet. It dispenses with the necessity of heating the cylinder before starting. To prevent heating the cylinder by the igniter flame, a small chimney is provided immediately over it, which conducts the flame away without coming in contact with the walls of the cylinder.

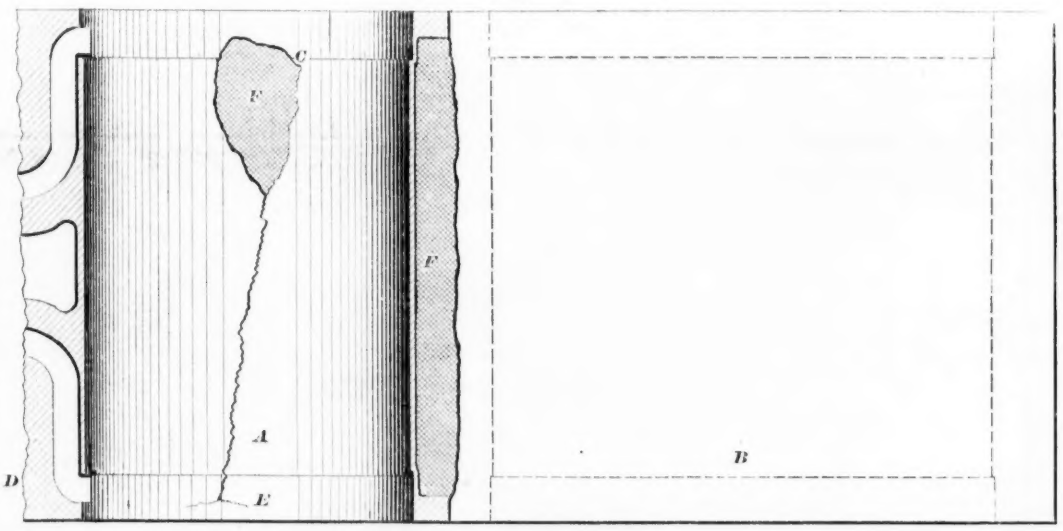
The gas is supplied through an ordinary pipe, or a rubber hose; but for the purpose of preserving a constant pressure, an equalizer is located near the engine. This is simply a rubber sack, easily distended by pressure, into which the gas is regulated to flow practically constant, and which forms a reservoir for equalizing the flow when the valve admits the gas to the cylinder.

The piston is fitted with metallic rings and works without lubrication. The construction of the engine is such that it may be readily taken apart for examination or repairs and as readily assembled.

### Singular Accident to a Cylinder.

BY LEWIS F. LYNE.

As the steam tug Hercules was steaming along the Hudson recently, and just entering the Highlands with a tow of barges, the engineer heard a click within the cylinder of the engine, followed by a rushing sound. He waited a moment to see if that was all there was of it, and discovering no further demonstration than a slowing down of the engine, he steamed on ten or fifteen miles to Cold Spring, where the cylinder head was removed to ascertain the cause of the trouble.




CYLINDER OF THE TUG HERCULES.

The engineer had supposed that the packing rings were broken, allowing the steam to blow through, but in this he was mistaken, for when the head of the high-pressure cylinder was removed it was found that a triangular-shaped piece of iron had been blown out of the side, and the cylinder split from top to bottom. The engine was a compound one of the tandem type; the high-pressure cylinder being 20″ diameter, and the low pressure 32″, with a stroke of 24″.

The arrangement of the cylinders will be better understood from the accompanying sketch, where *A* represents the high pressure, and *B* the low pressure cylinders, both of which were steam-jacketed as represented at *F*, *F*. The high-pressure cylinder is shown broken away through the ports at *D*.

The high-pressure cylinder *A* when new was bored to a diameter of 20″, but since then it has been rebored a number of times, the last time being about one year ago. Then it was bored to a diameter of $20\frac{1}{4}''$, and since then it has been almost constantly at work under a boiler pressure of 80 pounds per square inch. With a tow the engine made about 90 revolutions per minute, but in running the boat alone the engine averaged about 130 revolutions per minute.

Upon examination it was found that the piece blown out was of a triangular shape, being $5\frac{1}{2}''$ at the base and 9″ high. I inspected the fractured edges, and found a slight abrasion at *C*, and from this evidence concluded that the piece first let go at that point, and hinging around was blown out into the steam-jacket. This being true, the piece would fall to the bottom near *D*. With a bent rod I searched for and found it in the supposed position, proving that the first conclusion was correct. Subsequent measurement revealed the fact that the cylinder at *C* was but $\frac{5}{32}''$ thick; at the opposite upper corner $\frac{9}{32}''$, and at the bottom $\frac{3}{16}''$. As the casting gave way the pressure split the cylinder the entire length as shown, leaving a circular crack at *E* about 3″ long. It is astonishing that a cylinder so thin could have stood the severe test to which tug-boat cylinders are generally subjected. As the

question of the thickness of engine cylinders has been pretty freely discussed, this piece of information will probably be suggestive.

By the foregoing statement I do not mean to advocate putting less iron into cylinders; on the contrary, I believe in plenty of stock; but some have argued that cylinders below a certain thickness could not possibly stand. I found that the cylinder was so thin that no counter-bore had been allowed, so the packing rings in the piston had worn a shoulder at each end of the cylinder. These shoulders were not abrupt, but gradually inclined for the space of one inch or more, as lining up the connecting rod brasses had changed the travel of the piston from time to time, wearing the surfaces of the cylinder correspondingly. A few days previous to the accident the brasses had been lined up, which no doubt changed the length of the rod, causing the piston to travel in a new position.

This process had been repeated from time to time until the angle of the shoulders at the ends of the cylinder formed a wedge of sufficient magnitude, so that the packing rings being pressed upon them would be sufficient to split the cylinder.

The cylinder head was replaced at Cold Spring, after which the boat ran to Jersey City, where the cylinder head was again removed, the edges and shoulders trued up by filing, and a bushing of cast iron neatly fitted to the cylinder. This bushing was pressed into its place and a copper-wire gasket inserted at the top and bottom, to prevent steam and oil from getting behind the bushing. The bushing was bored out to 19¾" inside, and, after finishing it, was put in place; the cylinder head was replaced, and the Hercules went off about her work as if nothing had happened.

Brooklyn manufacturers and others who use steam power in their business places are moving for the passage of a bill by the next New York State Legislature to secure the exemption of steam boiler engineers from jury duty. They ought to succeed in this movement as the safety of life and property around steam boilers depends largely upon the presence and watchfulness of good engineers.

The National Exposition of Railway Appliances will be held in the Inter-State Exposition buildings, Chicago, Ill., opening about Thursday, May 31st, and closing about July 6th, 1883. Tracks are to be laid the entire length of the building (800 feet), and an abundance of steam power provided to operate machinery. The circular says:

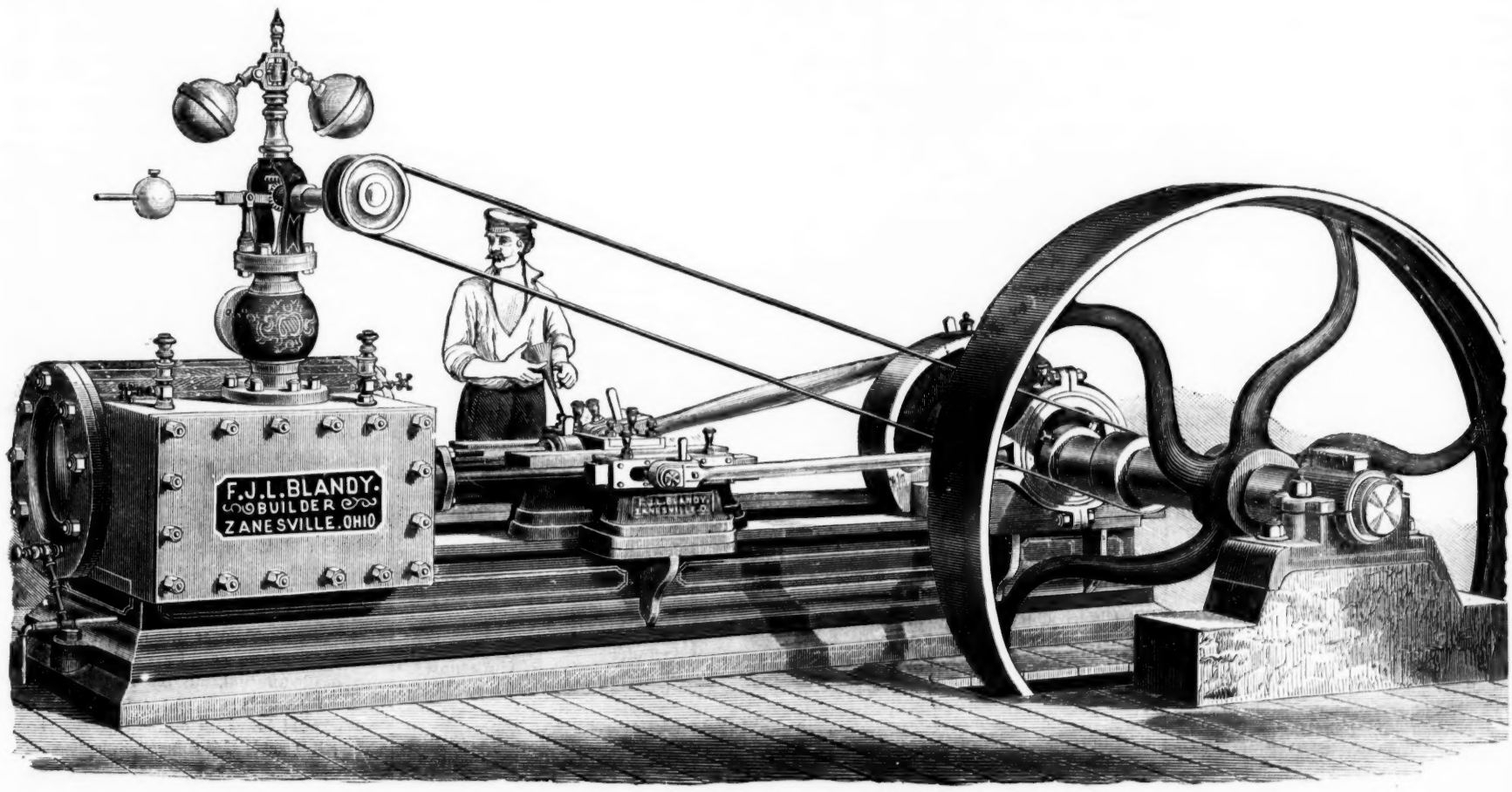
"A series of scientific and practical tests, to be made by well-known scientists and carefully-selected committees, extending to every article and every description of material susceptible of reliable test, will constitute one of the most interesting, as well as most valuable, features of the Exposition. An official record of these tests and of every exhibit, including a list of prizes awarded, will be made and published under direction of the Commissioners."

It is said that a large guarantee fund has been subscribed in Chicago sufficient to insure the financial stability of the undertaking.

We have published particulars at different times in regard to machine shop and iron foundry arrangements, but never in regard to a tool store. R. W. Rexford, 17 North 6th street, Philadelphia, is fitting up a new store for the sale of small machines, tools and supplies, which will be occupied on or before January 1, 1883. The room is 70x18 feet floor, and 13½ feet high, with good windows and entrance. The north wall is shelved solidly from floor to ceiling with the exception of 2½ feet at the top, where a series of closets fill the space, and cabinets of small drawers are built in to accommodate the numerous sizes and kinds of drills, taps, dies, etc , and five hundred and forty stock drawers of various sizes adapt themselves to the shelving, each compartment holding either 1, 3, 6 or 12, and the spaces being alike in all parts of the store, the drawers can be alternated or changed to any desired part. The south wall is shelved the same a portion of the length, where a series of strongly constructed bins from floor to ceiling for keeping set caps and coach screws, bolts, etc., finish the distance. Fifty feet from the front the floor is raised three feet above the main floor, and is, of course, twenty feet deep. In the northeast corner a cosy counting room is divided off by a glass partition. The space not occupied by same will be used for sample of amateurs' goods and small machinery. This raised part will be converted into a rack for shafting in convenient lengths and sizes for retailing stubs and American steel, brass rods, tubing, etc. Its capacity will be about 20 tons and the front will be concealed by doors when not in use. Goods will be exhibited in cases on counters and convenient places as is usual, besides which, a sample board will carry, as far as practicable, representative articles of the entire line of small goods; the drawers will be labeled with engravings of the contents, also other needed information. An index book will give the location of any desired article in the store, which will save the usual search in "trying to find it." The arrangement is such as to expedite business with a few reliable employes, instead of the usual large number of careless boys with a few pestered overseers. Mr. Rexford's mode of classifying goods and representing on one floor any article in his varied stock, from a small tool to an engine lathe, without being obliged to go to other parts of the building, is a first-rate feature.

### Blandy's Improved Slide-Valve Steam Engine.

The engraving presented herewith represents an improved slide-valve stationary steam engine, as made by F. J. L. Blandy, Zanesville, O. The improvements claimed consist chiefly in the proportion of parts as demonstrated by a long practical experience in the building and running of steam engines for various purposes, and excellence of workmanship. The bed of this engine is unusually heavy and well braced. The cylinder is strongly bolted to it, with the steam chest at the side, so that should any water accumulate within it will find a free exit; therefore the risk of knocking out cylinder heads from that cause is very slight. The crank is of the disc form, counterbalanced to insure steady running at high speeds. The wearing surfaces upon the pillow blocks, pins and parts that compose the valve motion are large, to secure good lubrication and consequent durability. The offset connection for the connection between the eccentric rod and valve stem is of substantial design, being composed of a large square bar with large wearing surfaces, so that it is free from twisting or jerking motion, hence the action of the valve is more prompt and its accuracy less readily affected than when less consideration is given to this connection.




BLANDY'S IMPROVED SLIDE-VALVE ENGINE.

The *Sanitary Engineer* in an able article reviews the trouble experienced in the streets of New York City, by tearing up pavements and excavating for laying and repairing the pipes of the two steam-heating companies, and one electric light company. It points out that while the interests of the companies have been guarded by civil engineers of high reputation, the convenience of the public who have the prior right to the free use of the streets, seems to have been neglected by the city officials who are paid to discharge that duty.

"The pavements of the most constantly used streets in the city have been torn up and replaced three times in succession to lay down three sets of pipes by three different companies, neither one of which apparently knew where the others had laid or proposed to lay their pipes, or had any definite ideas in advance of opening the trenches, what they proposed to do themselves. All this was bad enough in itself, but it is not the worst. In a number of places the streets have been torn up to correct defects in fittings and to discover the cause of imperfect insulation of the electric light wires, and there is every reason to apprehend that this nuisance will become chronic."

The vile system of patronage, political and social is charged with giving rise to the whole evil. The method of procedure for a company desiring to procure a franchise to occupy the streets is to engage some influential political wire-puller, or if necessary several of them, to work up the authorities to grant the concession. The next step is to get the co-operation of some wealthy contractor having political influence. Hard cash in advance is not essential, but pledging a share of the patronage is indispensable. In short, the well-known political machine methods are pursued with such results as might reasonably be expected.

"Now, we venture to say," says our contemporary, "that if Mr. Buel and Mr. Emery, the engineers-in-chief of the two steam heating companies, had been given, as they should have been, full charge of the work of fitting and laying the pipes, with absolute authority to remove at once any man detected in slighting his work, and to appoint and discharge inspectors, there would have been no settlement of pavements, and very little blowing out of joints. It is all nonsense to talk of the impossibility of refilling trenches so that pavements will not settle. It can be done, it has been done, and it should be done every time. It would be done if a contractor was fined fifty dollars for every settlement after he left the work."

The *Railroad Gazette* of Dec. 15th has information of the building of 74 miles of new railroad, making 9,648 miles thus far this year, against 7,601 miles reported at the corresponding time in 1881, 5,836 miles in 1880, 3,594 miles in 1879, 2,243 miles in 1878, 1,994 miles in 1877, and 2,283 miles in 1876.

## LETTERS FROM PRACTICAL MEN.

### Journal Bearings.

*Editor American Machinist:*

Having derived much information from your "Practical" columns, and like jokers, enjoying telling as well as hearing a good thing, I send you the following description of a journal bearing which I am using, and find at once good and cheap. A piece of heavy, seamless tubing, the length of the journal, is drilled all over in spiral rows, like a "metaline" box, with half-inch holes. The tube is then split in halves, so as to make the two halves of a box. Slightly countersink the holes on the inside to remove burrs, place in position in journal jaws, the shaft in its place and in line, and pour babbitt metal around it. The babbitt will key the tube fast, and at the same time leave soft spots of babbitt at all the holes. I should have stated that half-inch is the size hole I use for a three or four inch shaft; of course, the size should vary with the size of shaft.

M. C. R.

### Engine Lathe Improvements.

*Editor American Machinist:*

I notice in a recent issue of the AMERICAN MACHINIST a description of some very good lathe arrangements, by F. G. Woodward. It seems to me that the plan whereby the nut may be worked upon any part of the leading screw without reference to the position of the carriage, is one that ought to commend itself, and one which, if carried out in its full intent, would result in a material improvement in the quality of screws cut on a lathe; that is, after the lathe has been in use a few years. I am not sure but another improvement will be needed, viz., one to induce the workman to use the device in such a way as to cover the intentions of the designer, but any adverse criticism as against a meritorious design ought not to be tolerated on this ground.

There is one feature, however, of Mr. Woodward's arrangement to which I should be inclined to take exception; that is, the use of the lead screw as a rack for moving the carriage. It may be convenient, and all that, but I am decidedly of the opinion that the lead screw of a lathe ought to be used in cutting screws only. The improvement is manifestly calculated to maintain the truth of the screw, and it don't seem right to introduce an element of destruction, as would be done by converting it into a rack for moving the carriage.

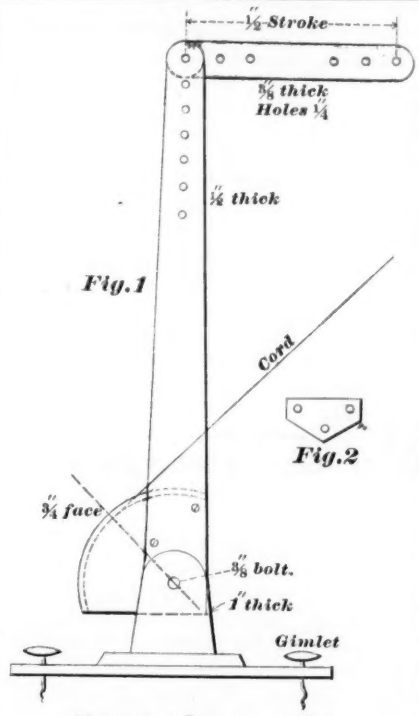
I would like to see something of Mr. Smith's idea of the diameter of head-stock spindles worked up into practice, and believe present efforts are in that direction. If carried to the extreme, indicated by him, it will be necessary to improve the present driving system, if it is ever expected to turn the spindle at its quickest speed. As at present constructed, with journals small in comparison with those he contemplates, driving on the small cone without back gears is a matter of considerable uncertainty. With reference to the curtailment of length of bearings, I am reminded of the fact that quite as much difficulty is experienced from the front bearing wearing down, from the overhanging weight, and to one side from the thrust of the tool, the resulting condition being reflected in the inability to face work true, or to bore a hole straight. It seems that while it may be all right to provide for stiffness, it is quite as important to eliminate, as far as practicable, the wearing out of line, which is best done by a long bearing surface for both front and back bearing.

FRANK GLEASON.

### Variable Indicator Rig.

*Editor American Machinist:*

The accompanying sketch, Fig. 1, shows a convenient indicator rig, intended to accommodate various strokes and heights of crosshead. The material is cherry, ¼″ thick for the long lever, which tapers from 3″ to 1½″ wide, and ⅜″ thick for the short link, which is 1½″ wide all along; ¼″ holes are bored at regular distances apart on the center lines of the levers. The base is of inch stuff, and the fulcrum is a ⅜″ bolt. All bolts fit




VARIABLE INDICATOR RIG.

snug, and have washers at each end. The quadrant is ¾″ stuff, centered on the fulcrum, and is so fastened to the long lever, by screws, or better yet, by "screw-eyes," that when the lever is vertical and the crosshead in the middle of the stroke, the cord to the indicator is a tangent to the center of the arc. The base is fastened by screws, gimlets or screw-eyes to the floor, if of wood; or may be held still by being heavily weighted.

The bolts are inserted in such holes as will make the short link half the stroke, and will bring it level when the long lever is vertical and the crosshead at half stroke.

If the crosshead is vertical and the cylinder horizontal, a stud tapped into the crosshead, preferably on the line of the piston, may be passed through the outer end of the short link. If the crosshead is horizontal, about as good a way as any is to make a piece of iron 3-32″ thick, the shape shown in Fig. 2, with two holes of the proper size and distance for the crosshead bolts, and one ¼″ for the bolt through the short link. The pointed end of this is turned up at right angles, at such a distance as will bring the face with the ¼″ hole snug up against the inner flat side of the short link, or if it will not reach so far, a wooden thimble, with ¼″ hole, may be used as a distance-piece.

All the pivot holes should be kept well lubricated with hog's lard and black-lead. Should the quadrant give a card of unsatisfactory length, a screw-eye may be run in on the center line of the flat face of the long lever, at the proper distance from the pivot.

Where the quadrant is not so inclined as to bring the cord tangent as shown, a guide-pulley must be used, so as to bring the first reach of the cord parallel with the piston rod (and at right angles with the center line of the long lever).

I forgot to mention that the rim of the arc should have a true flat groove turned in it, ¼″ wide and deep.

This rig may be inverted and screwed to the ceiling.

To calculate the distance of attachment of an indicator cord from the pivot of the lever, or the radius of the arc, required to give an indicator cord of any desired length, with any length of stroke of engine, or any distance of point of attachment to crosshead, from pivot of lever:

(This rule supposes the motion point to drive the main lever by a vibrating linked connection, or better yet, by a slot in the main lever.)

Divide the stroke into 4½ times the distance of the point of attachment from the pivot.

Thus: 18″ stroke, 30″ length of long arm; then attach cord $\frac{30\times4\frac{1}{2}}{18}=7\frac{1}{2}$ inches.

18″ stroke, 36″ distance of crosshead attachment from pivot; then cord attachment

$$\frac{36\times4\frac{1}{2}}{18}=9 \text{ inches.}$$

24″ stroke, 30″ length of long arm of lever; then short arm $\frac{=30\times4\frac{1}{2}}{24}5\frac{5}{8}$″

Remember that *the longer the stroke, and the shorter the distance from pivot to crosshead attachment, the shorter the radius of cord attachment.*

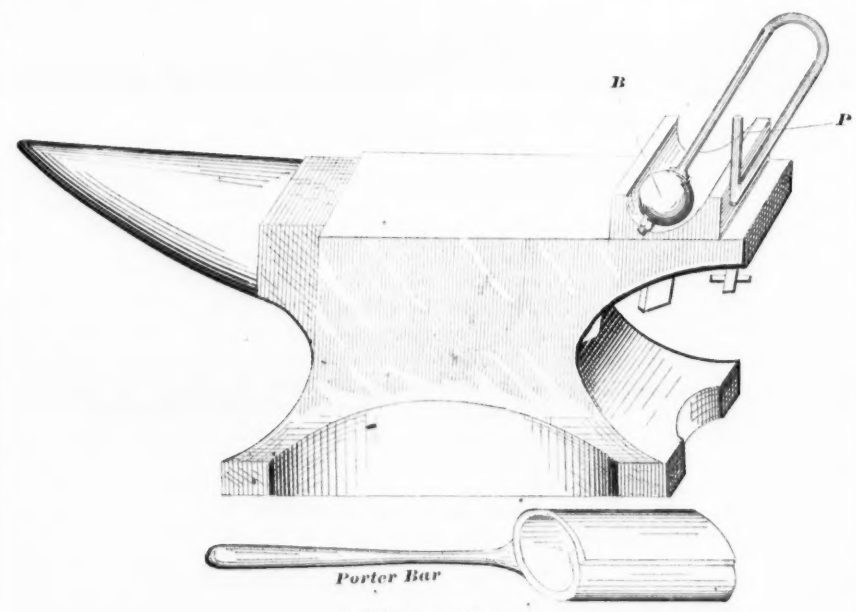
To produce an indicator card of any other length, substitute the desired length for 4½″ in the preceding rule.

The cord must get its first motion, next to the point of attachment, in a line parallel to the piston, and attached along the line of centers of the long lever. To do this a guide pulley must be used. Otherwise there will be needed a sector of a wooden circle, centered at the fulcrum.

Following we give a table showing the radius of arc required to give a 4½″ indicator diagram, with various strokes and distances of stud in crosshead from the pivot of the vertical lever:

| Stroke. | Length of long arm of lever. | | | | | |
|---|---|---|---|---|---|---|
| | 25″ | 26″ | 27″ | 28″ | 29″ | 30″ |
| 12″ | 9⅜″ | 9¾″ | 10⅛″ | 10½″ | 10⅞″ | 11¼″ |
| 14″ | 8 1/28″ | 8 5/16″ | 8 19/28″ | 9″ | 9 9/28″ | 9 9/16″ |
| 16″ | 7 1/32″ | 7 5/16″ | 7 9/32″ | 7⅞″ | 8 5/32″ | 8 7/32″ |
| 18″ | 6¼″ | 6½″ | 6¾″ | 7″ | 7¼″ | 7½″ |
| 20″ | 5⅝″ | 5 17/20″ | 6 3/16″ | 6 3/16″ | 6 39/40″ | 7 1/5″ |
| 24″ | 4 1/16″ | 4⅞″ | 5 1/16″ | 5¼″ | 5 7/16″ | 5⅝″ |
| 30″ | 3⅜″ | 3 9/16″ | 4 1/16″ | 4 1/16″ | 4 7/20″ | 4½″ |
| 36″ | 3⅛″ | 3¼″ | 3⅜″ | 3½″ | 3⅝″ | 3¾″ |
| 40″ | 2 13/16″ | 2 37/40″ | 3 13/80″ | 3 11/40″ | 3 11/80″ | 3½″ |
| 42″ | 2 57/64″ | 2 11/16″ | 2 25/32″ | 3″ | 3 3/32″ | 3 3/16″ |

R. GRIMSHAW.




A WELDING KINK.

### A Welding Kink.

*Editor American Machinist:*

When passing a blacksmith's forge a few days ago I noticed a smith endeavoring to (not very satisfactorily) weld a tube or sleeve of iron. It was apparently about 15″ long and 2½″ diameter × ⅝″ stock, boiler plate. He was using a beak iron, which, in consequence of its jar and temperature (he had not warmed it) did not make a clean inside weld (a lap weld was his instructions). A long bar held in a swage would probably have been better. However, conning the matter over some time afterwards, the annexed idea suggested itself to me, which I send to you to use if you think proper for a "kink," as it might be useful where better facilities do not exist.

When using the tool, I would suggest that the tube, when brought to the welding heat, receive first, one blow from the striker in the center, then one at each end prior to finishing the weld. If necessary the piece could be subsequently finished with a top-swage on a bar of machinery steel of less (slightly) diameter. The ball *B* can be cast iron. The point *P* is to mark the position of the ball for the guidance of the striker.

Toronto, Ontario. W. DICKS.

### A Bad Lubricant.

*Editor American Machinist:*

Can you, or any of your readers, explain the cause of the following curious action of paraffine oil? Last summer I was using such oil in fitting tail-stock spindles, and I found the workman driving one out with a sledge-hammer, with the sweat pouring off his face. I scolded and sweat to see him at work, but the sledge would not start it. He finally resorted to heating it over the fire, as I requested, and then held it while I tried the sledge, and after a great amount of hard work I drove it out. I scolded him for making the fit too snug; but he protested it was not too snug, but that he had shoved it in with his hand. I could not believe him, but to my surprise, upon examining the spindle and hole I could not find the least signs of hard contact. I finally advised him to try lard-oil, when the trouble ceased.

I would further state that I mixed half lard and half paraffine to be used around the shop, and found that it spoiled the lard-oil, as I never could pass through the shop without hearing some pulley or other bearing "squealing," and I found the bearings and pulleys red, with a matter resembling rust. I have for many years used paraffine, but never before with such results. My last experience will always be on my mind should I ever purchase any more.

I once saw a similar case in a cotton mill, where not only the bearings became rusty, but parts of the machinery with which the oil had come in contact were dotted with rust. This subject is of vital importance, not only in the wear of the machinery, but in the enormous power that must necessarily be lost in such a case. I am satisfied the occurrence is unusual, but the fact that it is liable to occur is sufficient reason that some light should be given on the subject. Is it water; is it acid; is it some chemical action, or what is it?

J. B.

### Tool Dressing.

*Editor American Machinist:*

I see very few remarks on tool dressing and tool rooms. The majority of shops out here are too small to admit of a regular tool room and an attendant. I would like to show a few of my old foremen just how their work is done, from a mechanic's standpoint. At the "Excelsior Iron Works" there are no flat wrenches, and only one monkey wrench to six hands. Perhaps it is a little mean that men employed year after year cannot afford a dollar to buy one, but what is the use of it? The foreman gets a late dinner and vents his wrath on A. Then A picks up his wrench, which he only bought a week ago, and goes over to the Capitolia shop, where a wrench is furnished him, and he finds he is a dollar out. But all is not lovely at the Capitolia. He finds cupboards all around the room, each containing its full supply of S wrenches, of taps and wrenches, of socket wrenches, with its keys and key drivers numbered according to some system. In each cupboard is a line of checks, and when he uses a tap he hangs his check opposite, so that when B and C want a tap wrench they know who used a tap last. If A has not returned the tap and check to their proper places, and if C is careless and don't hang up his check, he catches a "bad cold"—from the foreman. All this system is very nice,

but deliver us from the lathe tools. X is soon hired. He knows what tools he needs and it "breaks him all up" to run around to the shaper, planer, and every lathe in the shop when he wants his side tool. He likes to grind out the round point some apprentice has left on it. Finally the foreman says: "I'll have to find some way to cure your love for the blacksmith." "Well," says X, crossly, "give me a tool or two and I'll stay out. I want

1 right diamond point,
1 left diamond point,
1 right side tool straight,
1 right side tool angular,
1 left side tool straight,
1 left side tool angular,
1 thread tool straight,
1 thread tool angular,
1 thread tool $\frac{1}{16}$ wide,
1 cutting-off tool straight,
1 cutting-off tool angular,
1 brass tool,
1 broad-nosed tool,
1 round-nosed tool $\frac{1}{2}$" wide,
1 round-nosed tool $\frac{1}{4}$" wide.

He got them three months ago. Since then the blacksmith has dressed an average of 3 tools a week for each lathe. He only dresses on Mondays, except for a break. It would seem as if this was a slim supply, but it is better than the usual supply. All boring tools are made out of square steel $\frac{1}{4}$"×8" long, $\frac{3}{8}$"×10", $\frac{1}{2}$"×12", $\frac{3}{4}$"×16", with two pieces of steel $\frac{1}{4}$" and $\frac{1}{2}$" thick to raise them to the tool post screw. These tools have been used by the writer for two years on job work, and have given far better satisfaction to employer and mechanic than tools made in the usual way.

Des Moines, Ia. ROBT. P. BROWN.

### Machine Tool Notes.

*Editor American Machinist:*

Of all the plans for raising and lowering the lathe tool that have come out for the last thirty years, the simplest and best, in my opinion, is Vanhorn's, patented in 1855. This plan is as rigid as a solid block, no dirt has access to the slide, and the tool is raised and lowered square. Very little attention is paid to this subject by English builders. They are more in favor of power and stiffness than of handiness. Many of them use compound rests for all sizes of lathes, and the taper is always done, if possible, with the slide rest. Some have a taper attachment, but the tail stock on many of them cannot be set over. Centers do not work so well with set-over headstocks, but it cannot be avoided where there is no compound rest. There is a wide contrast between the engine lathes of Old and New England, at least what some years ago was called the "Yankee lathe;" that is the lathe with a light hollow fast headstock, and small cone and gear wheel; a weighted carriage mounted on two small inverted Vs, with a ball and socket and screw on the back of the carriage for raising and lowering the tool. This type sacrifices power and rigidity to handiness. Some of the modern Massachusetts builders make as heavy, powerful and stiff lathes as are made anywhere else.

Concerning the loose headstock, I would have a boss of three inches long at the center end of the spindle, so that in heavy cutting the spindle would project as little as possible.

For tightening the spindle, the best plan, in my opinion, is the slotted cone with a thread on the inside end. This plan neither presses the spindle down nor pulls it up, but tightens it longitudinally, as it should be. I prefer a hand fly-wheel on the end of the spindle for the screw; also short holding down bolts.

Some of the axle lathes have well designed headstocks, for stiffness. Bodmer made quite a number of large lathes forty years ago, with conical spindle journals working in cast iron bearings, with long taper holes bored in the fast headstock—no bushing or boxes—and they wore first rate. I believe hard cast iron will wear better than brass.

If large hollow spindles answer for bolt capstan rests and die lathes, why not for boring and turning? The great advantage of the powerful stiff lathe for heavy cutting is, you can take the heavy cut almost down to the size at one cut, and leave only the tool marks for the finishing cut to obliterate. A man once assured me that during the war he had frequently drawn $200 a month running a locomotive driving wheel lathe. His wages were nearly $4 a day; time and half for overtime up to 12 at midnight, double time after that, and double time for Sundays. I have an idea that railroad companies are getting their tire bored and turned on somewhat cheaper terms at present.

If Mr. Smith advocates a 7½" spindle for a 20 lathe, what size would he want for 6 foot driving wheel lathe? He has evidently figured up what could be got out of a lathe by having the weight, power and size in the right place, and if a man desired to make money and overtime by light cuts and fine feeding, he would find him a difficult customer.

In many shops in England, the practice is to have two grindstones to revolve together, in order to keep each other flat and true, with an arrangement for tightening, and furnished with the usual iron rests on the outside of the stone. This is a very good plan. A machinist informed me that at Delamater's, in New York, the same plan was practiced, and a notice hung up: "For machinists only." It is just as necessary for a machinist to have a true stone to grind his tools on, as it is for a pattern maker, and the plan of allowing every Dick, Tom and Harry to grind and let heavy pieces of iron bob up and down on the top of the stone is a perfect outrage. A properly ground tool for heavy cutting with a coarse feed, requires far less power to drive it, besides it preserves its cutting edge without softening, much longer. A great deal of bad grinding and improperly shaped tools seen in country shops is caused by having no rest to lay the tools on.

Who is it that turns out corduroy work and is always quarrelling with the toolsmith? The man who grinds his lathe tools more and more dumpy every time he goes to the stone. You might enter every engine or machine shop in Britain, from Johnny Groat's to Land's End, and you would not find one in which the grindstone was not provided with an iron rest, bolted down on the front of the stone. Observe a man grinding a large round-nosed tool on an iron rest in front of the stone. See how nicely he works it round, held easily but firmly with both hands. For doing good, smooth, close work there is more in the grindlng and setting of tools than in anything else. VETERAN.

Fort Wayne, Ind.

NEW PORTABLE FORGE.

### New Portable Forge.

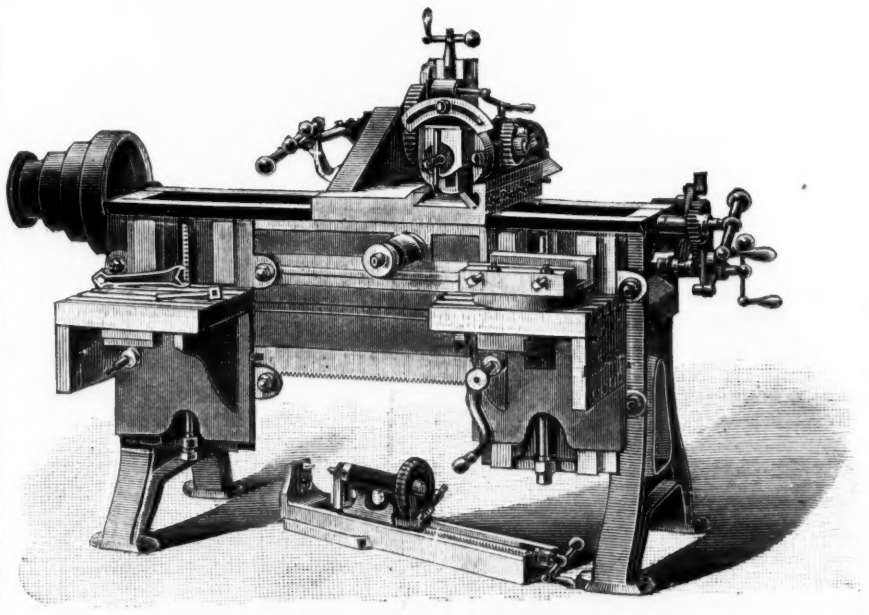
We illustrate with this a portable forge, just brought out by the Empire Portable Forge Company, of Cohoes, N. Y. This forge is especially designed for the use of blacksmiths and carriage makers, its capacity, we are told, being equal to that of the largest brick forge and hand bellows. If run by power, it is ample for the largest carriage shop work.

The fire pan is 28"x40", and 4" deep, with a depression at the tuyere of something over 4", thus providing for a heavy fire when necessary. The sides of the fire pan are cut away at the front and rear, for the convenience of manipulating the work.

The adjustable tuyere and cut-off with which this forge is provided admits of rotating the arbor, to which the valve is attached, to any desired extent, thus accurately gauging the blast without disturbing the fire.

The blower is of an improved pattern and of very large size, giving a powerful blast when wanted. The body of the forge is only 25" high, making it convenient for heavy work. The hood is arranged for the easy attachment of a pipe.

This forge is made to be run by hand, or power, as desired, or is furnished without the hood, blower or gearing.



TWELVE-INCH SHAPING MACHINE.

### Twelve-inch Shaping Machine.

The accompanying engraving represents a shaping machine built by Fay & Scott, of Dexter, Me., and sold by the George Place Machinery Company, of New York. This machine has a stroke variable from 0 up to 12 inches, and the saddle slide that carries the bar, or ram, has an automatic horizontal feed of 40 inches. The total length of bed is 4 feet 10 inches. The bar is driven by gearing, arranged with the Whitworth quick-return movement. Both the length of the stroke and the position of the bar are quickly adjusted with the machine in motion.

The tool head may be fed either vertically or at any desirable angle, a distance of four inches, and is also provided with circular feed for planing the inside arcs of circles with the automatic circular feed, and with the mandrel and cones furnished, the entire outside of the circle may be fed over. The arrangement of all feeds is such as to feed on the return stroke, or while the tool is not cutting.

The angle irons for supporting the platen, vise, centers, etc, have a vertical adjustment of 15 inches, by means of a screw, while by means of a rack and pinions underneath the bed, they are readily moved to any desired position lengthwise of the bed.

The vise will swing to any angle, being graduated for the purpose of setting as required. The gear and driving worm are proportioned so as to be available for indexing, when desired. The gears are cut from the solid, the smaller ones being of steel. The screws, studs, shafts, etc., are also of steel. All sliding surfaces are scraped to surface plates.

The vise, circular-feed mandrel, countershaft and wrenches are furnished as part of the machine. When desired, centers are furnished to receive work 18 inches long and 8 inches diameter, the head-center being provided with an indexed gear and worm. The total weight of the machine is 3,100 lbs.

Asbestos is not a rare mineral, as it is found in most of the middle and northern States in this country, and in Europe, in all mountainous sections. In New York there is a deposit in Richmond county which affords fibers *two feet long*. In Brunswick, New Jersey, there is a fine deposit of the interlaced variety, the mountain leather, so-called. In Maryland, asbestos of good quality is found in several localities. In Massachusetts it occurs at Brighton, Sheffield, Pelham, Windsor, and several other towns. The mineral is plentiful enough for all our wants, even if, some day, it is used in house construction, an event not improbable.—*Boston Journal of Chemistry.*

*The National Labor Tribune* gives the following sensible advice to its readers:

"In their own interests we would advise all workingmen to give the savings banks or the 'old sock' at home some degree of attention. If nothing bad in business overtakes the country all the better, and it is hardly necessary to intimate that a little pile of money laid away will not, because of continued fair times, come amiss."

An Eastern contemporary notes that a Prussian has found a new use for flour. He manufactures molded or rolled articles from flour by a special process, and they gain a stone-hard condition, and can be hardened, colored, etc. Our contemporary evidently never tried its teeth on a Chicago restaurant biscuit, or it would not have said that process was new.—*American Miller.*

## Using Open Feed Water Heaters.

The Hartford Boiler Insurance Company says in the last issue of the *Locomotive:*

"We have frequently warned manufacturers against using open heaters, especially where the water was heated by exhaust steam from the engine. The oil contained in the exhaust steam is very liable to make trouble, especially if the feed-water is impure, or contains carbonate of lime or magnesia, or organic matter in any considerable quantity. The oil or grease combines with these substances, and forms a conglomerate mass that is sometimes especially troublesome. We have not unfrequently found the fire sheets of boilers greatly overheated from this cause, and their strength destroyed. A deposit which would naturally fall down as a fine powder and be easily blown out, soon mixes with the grease, forming a pasty substance which adheres to the plates, and when the boilers are blown down it at once bakes on to the hot plates and is removed with no little difficulty. We have removed this deposit from boilers when the amount of organic matter was large, and when dried it burned readily on being put into a gas flame. The amount of oil daily used by engineers in the cylinder of an engine varies considerably. For instance, in eighty H. P. engines we have known the quantity to vary from one-half pint to more than a pint, and the larger quantity makes the most trouble. These difficulties have been remedied by substituting coil or tubular heaters. Another trouble which occasionally occurs in the use of condensed water is this. The drip of condensation from cotton mill slashers and dressers is sometimes returned to the boiler. We have found in some cases that the boilers at once began to show internal corrosion. A recent case,—two nearly new boilers had been running since placed in position with good results. The condensed water from the slashers was subsequently fed to the boilers and signs of internal corrosion began to appear.

"The cause of this we attribute to the steam having been in contact with the copper drying cylinders, large and small. This theory is not fully established in our minds, but from the cases which we have seen, we believe corrosion has occurred from this cause. The quality of water, however, may have had much to do with it."

## On the Comparative Economy of Condensing and Non-Condensing Engines.

BY C. W. COPELAND.

*The following was contributed to the technical press by the author more than forty years ago, and a copy of it having come into our possession we republish it for the purpose of giving it, as far as may be, the publicity to which we think it entitled.*

That steam may be used in an ordinary non-condensing engine, of such an elasticity as shall make it fully equal in economy of fuel to the low-pressure condensing engine commonly employed in English practice, has long been believed by many engineers, both scientific and practical, to be a point that can be easily proved.

The writer records his own adherence to this belief, notwithstanding it involves a supposed law upon the pressure and density of steam greatly at variance with the opinions of several eminent writers upon the steam engine. Thus, according to Dr. Lardner, from whom we take the following extract, it would seem to be immaterial in what manner, or in what kind of engine, steam is used, and that all experiments and research to determine in what way to realize the greatest mechanical effect therefrom have been entirely useless.

"The same quantity of water being converted into steam, produces the same mechanical effect, whatever be the *pressure* or *density* of the steam."—*Dr. Lardner on the Steam Engine, p. 279, American edition.*

But the opinions of this author are sometimes fallible; witness his arguments respecting the practicability of establishing a regular communication, by the power of steam, between Great Britain and the United States, which have been proved erroneous by more than two years' experience; and we shall venture to assert that he greatly errs in the above statement, appealing, as we confidently can, to the experience of almost every practical engineer to sustain the assertion.

To return, however, to that particular application of steam which is most immediately the subject of this paper. We shall endeavor to show that there *is* a pressure at which, if a non-condensing engine be worked, it will, for a given mechanical effect, equal in economy in the consumption of fuel the low-pressure condensing engine of the English practice, and that this pressure is safely and with certainty attainable.

In treating of the density and pressure of steam relatively to each other, the subject has become so mystified and obscured by the contradictory statements of different authors, that the practical engineer is at a loss in what manner to understand the ratio of increase, or what reason to assign for it. That this is the case is shown by the extracts which follow, taken from the works of several writers upon the steam engine.

"And they also show that the bulk or volume of steam is *inversely as the pressure*, when the temperature is not altered; and conversely the *density is directly as the pressure.*"—*Vide Tredgold, Woodhouse's edition, p. 52.*

"That the bulk which steam fills is diminished in the same proportion as the pressure of the steam is increased; or, in other words, that the *density* of steam is always in the *same proportion* as its *pressure.*"—*Lardner upon the Steam Engine, p. 279, American edition.*

"It may likewise be remarked, that the variation of the density or specific gravity of steam is only *strictly proportional* to its pressure or elasticity when the temperatures are the same."—*R. Wallace's Practical Mechanic's Pocket Guide, p. 43.*

"This arises from the fact that the density of steam increases *nearly* as fast as the pressure under which it is generated. Did both increase *in* the *same* ratio, there would be nothing gained by the use of high steam."—*Renwick on the Steam Engine, p. 162, new edition.*

In addition to this last extract, we append the following, taken from the same work, which directly contradicts it:

"It is a law which holds good in *all* elastic fluids, that they occupy spaces which are inversely as the pressures to which they are subjected, and their densities are in consequence in the *direct ratio* of the pressures."—*Renwick on the Steam Engine. p. 14, new edition,*

But in order, if possible, to confuse the student or engineer still more, there are given in almost all of the works from which the extracts are taken, tables, showing the number of volumes of steam for a given pressure compared to the volume of water that produced it, and consequently showing that the density *does not* increase in the same ratio as the pressure.

By the term density, used in the foregoing extracts, is understood the specific gravity of steam, and it will be seen by examining them that the fourth extract directly contradicts all the others; yet, notwithstanding this large majority against it, we have no hesitation in saying that it is correct.

We will now endeavor to show *why* the non-condensing engine, working at some given pressure, *is* equal in point of economy of fuel to the low-pressure condensing engine. This we conceive to be attributable to two distinct parts of the operation;

1. The greater economy of fuel in the generation of steam of a high pressure compared with that of a lower one.

2. The economy arising from the superior effect produced by the steam, when used at a high pressure, to that when used at a lower one.

In order to show that the above-mentioned causes are those to which the asserted economy in the use of high pressure steam is due, it will be necessary to introduce the following table, showing some of the properties of steam, the three first columns of which are extracted from a similar one published in Pambour's Theory of the Steam Engine; the fourth column is calculated from the comparative volumes of steam to the volumes of water that produced it; and the fifth is calculated from the fourth. Similar tables containing the first three columns can be found in almost every scientific treatise upon the steam engine: this is selected merely from the fact of its being more complete than most of them.

In this table we have made a total pressure of 15 lbs. per square inch our starting point, and throughout this article we shall consider it equal to the pressure of the atmosphere, although, strictly speaking, it is a fraction greater; but it is sufficiently correct for our purpose.

By examining the following table, it will be seen that, whenever the pressure is doubled, the density, as given in the fourth column, falls greatly short of it. For instance, at 15 lbs. pressure the density is represented by 100; and at 30 lbs. or double the pressure, the density is but 189.

| Total pressure in lbs. per square inch. | Corresponding Temperature by Fahrenheit's Thermometer. | Volume of steam compared to the volume of water that produced it. | Rel. dens. of the steam—that at 15 lbs. or the pressure of the atmosph. being called 100. | Pressure of the steam if only in a direct ratio of the densities—in lbs. |
|---|---|---|---|---|
| 15 | 213.0 | 1669 | 100 | 15.0 |
| 20 | 228.3 | 1280 | 130 | 19.5 |
| 25 | 240.7 | 1042 | 160 | 24.0 |
| 30 | 251.2 | 882 | 189 | 28.3 |
| 35 | 260.3 | 765 | 218 | 32.7 |
| 40 | 268.4 | 677 | 246 | 36.9 |
| 45 | 275.7 | 608 | 274 | 41.1 |
| 50 | 282.3 | 552 | 302 | 45.3 |
| 55 | 288.4 | 506 | 330 | 49.5 |
| 60 | 294.1 | 467 | 357 | 53.5 |
| 65 | 299.1 | 434 | 384 | 57.6 |
| 70 | 304.2 | 406 | 411 | 61.6 |
| 75 | 308.9 | 381 | 438 | 65.7 |
| 80 | 313.5 | 359 | 465 | 69.7 |
| 85 | 317.8 | 340 | 491 | 73.6 |
| 90 | 321.9 | 323 | 516 | 77.4 |
| 95 | 325.8 | 307 | 544 | 81.6 |
| 100 | 329.6 | 293 | 569 | 85.3 |

Again, at 40 lbs. pressure, the density is 246; but at 80 lbs., or, double the pressure, it is but 465.

And again at 50 lbs. pressure the density is 302; but at 100 lbs., or double the pressure, it is but 569.

By referring to the fifth column, which represents the pressures that the steam should be equal to, provided the law given in the majority of the extracts quoted in the first part of this paper was correct—viz., "that the density is directly proportional to the pressure,"—we find a great discrepancy between these and the actual pressures. For instance, at a temperature of 251.2 degrees, the pressure is stated in the first column at 30 lbs.; but by running the eye across to the fifth column, we find, if this law be correct, that the pressure should be only 28.3 lbs.

Again, at a temperature of 329.6 degrees, the pressure, as given in the first column, is 100 lbs.; but by examining the fifth column, it appears that the pressure, to be strictly proportional to the density, should be only 85.3 lbs. The numbers in this column also show the relative amounts of fuel required to maintain the steam at the pressures given in the first column.

Now let us examine whether or not the numbers given in the fourth and fifth columns are correct; and in order to do this it will be necessary to institute a comparison between the first and third columns. In so doing, it will be found that the volumes of steam (as compared with the volume of water which produced them) are not precisely in an inverse ratio to the pressure; but that when the pressure is doubled, the volumes of steam are greater than one-half of the number at the former pressure. As an instance, take 15 lbs. pressure in the first column, the corresponding volumes of steam in the third column are 1669; now, at double the pressure, or 30 lbs., the volumes of steam are 882, being about 47 volumes greater than one-half the number of volumes at 15 lbs pressure. As another instance, take 50 lbs. pressure; the corresponding volumes of steam are 552; but at double the pressure, or 100 lbs., the volumes are 293, or 17 volumes greater than one-half.

The volumes of steam proportional to the water which produced them, and also the temperature of steam at different pressures, as given in the foregoing table, have been proved correct by numerous experiments, and implicit reliance may be placed upon their accuracy. Now, as the fourth and fifth columns are calculated from the column of the volumes of steam, we think the whole table may be considered correct.

It is necessary to be thus particular in showing the accuracy of the foregoing table, as the whole of the following chain of reasoning, which is to show the cause of the asserted economy of high-pressure engines, is dependent thereon for its value; therefore, if the table be inaccurate, the whole must be fallacious.

It has been satisfactorily ascertained, by numerous well-conducted and accurate experiments, that any given amount of fuel will convert a certain quantity of water into steam, without regard to the pressure under which it is evaporated; or, in other words, the same amount of fuel that will evaporate a cubic foot of water, under a pressure of steam equal to one atmosphere, would evaporate the same quantity, were the pressure of steam equal to five or ten atmospheres.

It follows from this, that the amount of fuel required to generate steam of different pressures is in the direct ratio of their densities; therefore, if we represent by 100, the quantity or weight of fuel required to generate a cubic foot of steam of a total pressure of 15lbs., or one atmosphere, the fourth column of the table, (or the column of relative densities,) will show the relative amount of fuel required to generate a cubic foot of steam of any other pressure given in it.

We shall see, by reference to the table, that allowing 100 parts of fuel to be required to generate a cubic foot of steam of 15 lbs. pressure, but 189 instead of 200 parts are required to generate the same bulk of steam of 30 lbs. pressure; and but 357 instead of 400 parts are required to generate the same bulk of 60 lbs. pressure.

It follows, therefore, that the pressure and mechanical efficiency of steam increase in a greater ratio than the consumption of fuel; consequently, we may arrive at so great a pressure, in the use of steam in non-condensing engines, as that the advantage gained in this manner shall equal in effect that acquired by condensing the steam in a low-pressure engine.

We conceive that we have thus established the truth of the first reason assigned by us for the economy of high-pressure non-condensing engines, viz.: "the greater economy of fuel in the generation of steam of high-pressure compared with that of a lower one."

After having examined the foregoing table, and followed out the chain of reasoning here presented, the question naturally arises, *why* the pressure of steam increases in a greater ratio than the density?

We will now endeavor to explain as clearly as possible, what we apprehend to be the cause.

Suppose a boiler to be charged with water and steam, in a similar manner to a boiler in ordinary use, at a pressure of 15 lbs., and consequently at a temperature of 213 degrees, and the pressure is increased to 40 lbs., the temperature is consequently raised to 268.4 degrees, or an addition of 55.4 degrees. By reference to the fifth column of the table, it will appear that, had the pressure increased only in the same ratio as the density, it would be but 36.9 lbs., instead of 40 lbs.; the difference, or 3.1 lbs. remains to be accounted for.

It is a known law that gases expand about $\frac{1}{480}$ part for every degree of increase in their temperature; and if confined, instead of expanding $\frac{1}{480}$ part, the pressure in the vessel by which it is contained will be increased $\frac{1}{480}$ part.

Now, returning to the foregoing supposition, the 55.4 degrees of heat, added to increase the pressure to 40 lbs., acts in two ways: first, by an increase in the density of the steam by the evaporation of more water; second, by increasing the temperature of the steam.

According to this law of the expansion of gases by heat, increasing the temperature of the steam must increase the pressure that is already produced by the increase of its density $\frac{1}{480}$ part for every degree that the temperature is increased. Let us now see what will be the result of this mode of reasoning at three different pressures—say at 40 lbs., 60 lbs., and 100 lbs.

As stated before, the pressure of the temperature of 268.4 degrees is 40 lbs.; but if the pressure were only in proportion to its density, it would be but 36.9 lbs.; and to increase the pressure from 15 lbs. to 40 lbs., there has been an addition to the temperature of 55.4 degrees;

therefore, $\frac{36.9\times55.4}{480}=4.26$ lbs. increase in the pressure; and 36.9+4.26=41.16 lbs. instead of 40 lbs., or a difference of 1.16 lbs.

At the temperature producing a total pressure of 60 lbs., the pressure would be only 53.5 lbs., if it were in proportion to the density, and the addition to the temperature above that of 15 lbs., or the pressure of the atmosphere, is 294.1−213=81.1 degrees;

therefore, $\frac{53.5\times81.1}{480}=9.04$ lbs. increase of pressure; and 53.5+9.04=62.54 lbs. pressure, instead of 60 lbs., the real pressure, or a difference of 2.54 lbs.

At the temperature producing a total pressure of 100 lbs., were the pressure in proportion to the density, it would be but 85.3 lbs., and the addition to the temperature above that of 15 lbs. is 329.6−213=116.6;

thence, $\frac{85.3\times116.6}{480}=20.7$ lbs. increase of pressure, and 85.3+20.7=106 lbs., or a difference of 6 lbs.

We are of the opinion that the discrepancies existing between these results and the actual pressures may be fairly attributed to an incorrectness in the elements of, and not to the principles embodied in, the calculations, as a very slight difference between the given temperature, or volumes for any pressure, and the actual temperature or volumes, would be sufficient to correct those discrepancies; or the fraction given as the expansion of gases for each degree the temperature is increased, viz., $\frac{1}{4\frac{1}{10}}$ part, may not be the *exact* expansion; and where the temperature is increased so many degrees, as in the foregoing cases, it would sensibly affect the result.

We conceive, however, that these results approximate sufficiently near the actual pressure to show the principles to be correct upon which the calculations are founded.

We now come to the second reason assigned for the economy of high pressure engines, viz., "the superior economy in the consumption of steam by the engine when used at a high-pressure instead of a lower one."

This arises from the fact that the total amount of losses from the pressure of the atmosphere, friction, or other causes, does not increase in the same ratio as the effective pressure of the steam acting upon the piston, but is nearly a constant quantity; consequently, the greater the pressure of the steam upon the piston, the smaller will be the ratio between the sum of the losses and the whole force exerted.

In order to show this clearly, we will compare the results produced by a non-condensing engine, working under two different pressures, say with pressures above the atmosphere of 20 lbs. and of 80 lbs., or total pressures of 35 lbs. and of 96 lbs., per square inch upon the piston, and thus exhibit the ratio between the losses and the whole force exerted by the different pressures. But, to be able to accomplish this, we must first determine the amount of the losses in each case.

The items of loss, when working under a pressure of 20 lbs. per square inch above the atmosphere, we will suppose to be—

| | |
|---|---|
| Press of atmosphere, per square in. | 15.00 lbs. |
| Power required for working valves. | 0.50 " |
| " " " " pumps. | 0.50 " |
| Friction of piston | 1.00 " |
| Friction of journals and other working parts | 3.50 " |
| Total amount of losses | 20.50 lbs. |

Now, 20 lbs.+15, pressure of atmosphere=35 lbs.; and 35.00—20.50 lbs.=14.50 lbs. pressure, the whole effective force exerted per square inch upon the piston by the engine, and being 41.4 per cent. of the whole power upon the piston.

The total amount of losses, when working under a pressure of 80 lbs. per square inch above the atmosphere, is but little greater than when the pressure is but 20 lbs. above the atmosphere; for it is evident that the principal item of loss, which is the pressure of the atmosphere, is the same in both cases; and the increase of friction of the piston, journals, etc., is but trifling. The items of loss will then be—

| | |
|---|---|
| Pressure of atmosphere, per square inch | 15.00 lbs. |
| Power required for working valves | 2.00 " |
| " " " " pumps. | 2.00 " |
| Friction of piston | 1.50 " |
| Friction of journals and other working parts | 4.50 " |
| Total amount of losses | 25.00 lbs. |

Thence, 80 lbs.+15 lbs. pressure of atmosphere=95.00 lbs.; and 95.00—25.00=70.00 lbs. pressure per square inch, the whole force exerted upon the piston, by which a useful effect is produced, being 73.7 per cent., nearly, of the whole force upon the piston.

Thus, theoretically, there is 32.3 per cent. more power usefully applied, when working at the higher than at the lower pressure, but practically the difference is not so great as here represented, as there is almost necessarily a greater loss from leakages, and greater radiation of heat from pipes, cylinders, etc., when working at the former than at the latter pressure.

Having thus, as we think, satisfactorily shown not only that it is more economical to generate steam of a high pressure than a lower one, and also to use it at a high pressure in working non-condensing engines, but that there is some given pressure at which, if used in non-condensing engines, it will render them equally economical with the ordinary condensing engine used in the English practice, we will endeavor to ascertain what that pressure should be, supposing the steam to be worked at its full pressure during the whole length of the stroke of the engine. For the condensing engine we will assume as the working pressure, 5 lbs. per square inch above the atmosphere, or a total pressure of 20 lbs. per square inch. The items of loss in this engine will be:

| | |
|---|---|
| Imperfect vacuum, per square inch, | 2.25 lbs. |
| Power required for working valves, | 0.50 " |
| " " " " pumps, | 0.75 " |
| Friction of piston | 0.40 " |
| Friction of journals and other working parts | 2.25 " |
| Total amount of resistances in condensing engine | 6.15 lbs. |

By reference to the fourth column of the table given in the first part of this article, it will be observed that, by assuming the fuel required to maintain the steam at the pressure of the atmosphere at 100 parts, the amount required to maintain the steam at 20 lbs., will be 130 parts.

Now, the total pressure upon the piston is 20 lbs., and the total amount of resistance is 6.15 lbs.; thence, 20 lbs.—6.15 lbs.=13.85 lbs. pressure per square inch as the available power; this is obtained at an expense of 130 parts of fuel; thence, $\frac{130}{13.85}=9.38$ parts of fuel, to obtain 1 lb. pressure per square inch available power upon the piston.

Our object now is to find at what pressure per square inch it is necessary to maintain the steam for a non-condensing engine, so that each 9.38 parts of fuel will produce 1 lb. pressure per square inch upon the piston available power. This will be found to be 60 lbs. total pressure, or 45 lbs. pressure above the atmosphere, as the following calculation will show. The items of loss may be estimated thus:

| | |
|---|---|
| Pressure of atmosphere per sqr. in. | 15.00 lbs. |
| Power required for working valves, | 0.90 " |
| " " " " pumps, | 0.90 " |
| Friction of piston | 1.20 " |
| Friction of journals and other working parts | 4.00 " |
| Total amount of resistances | 22.00 lbs. |

The whole pressure upon the piston is 60 lbs per square inch, and the whole amount of resistance is 22 lbs. per square inch; thence, 60 lbs.—22 lbs.=38 lbs. pressure per square inch available power, which is obtained, as will be seen by reference to the fourth column of the table, by an expenditure of 357 parts of fuel;

then $\frac{357}{38}=9.39$ parts of fuel for each pound available pressure per square inch upon the piston.

It would thus appear, that by working a non-condensing engine with steam at a pressure equal to 45 lbs per square inch above the pressure of the atmosphere, the expenditure of fuel in proportion to the available power is nearly the same as in working a condensing engine with a pressure of steam equal to 5 lbs. per square inch above the pressure of the atmosphere.

But this pressure is only *theoretically* equal in economy of fuel to the condensing engine;

UPRIGHT DRILLING AND MILLING MACHINE.

practically, a pressure would be required somewhat greater, from the loss by leakages, radiation of heat, etc., being greater in the non-condensing than in the condensing engine.

We believe that every engineer who has had experience in working both classes of engines, is fully satisfied of the truth of the proposition set forth in the commencement of this paper, viz.: "that a non-condensing engine may be worked with steam of some given pressure per square inch, that shall equal in economy the ordinary condensing engine used in the English practice."

Our object has been to give some satisfactory explanation why this is the case; and in attempting to do this we will not pretend that the items of resistance given for each description of engine are precisely correct, as we have stated them according to our judgment, having no experiments to refer to from which to arrive at their precise amount; neither do we pretend that the calculations are made with mathematical accuracy, as our purpose did not require it; but if any of the principles and reasonings here advanced, upon which these calculations are based, are incorrect, or founded upon incorrect premises, we should be as much gratified to see them disproved as any one; our only object being to arrive at a correct exposition of the fact.

---

Stock gambling has recently experienced a check. The daily "business," or pretended sales of shares at the New York Stock Exchange has, within the last few weeks, decreased about one-third.

---

A cargo of pig iron sunk in Long Island Sound, off Saybrook, Conn., twenty-seven years ago, is now being recovered by divers. The iron comes out from under the sand in good condition.

## Hall's Upright Drilling and Milling Machine.

The machine illustrated herewith, designed for the use of jewelers and others requiring a tool of this class, is manufactured by the J. G. Hall Manufacturing Co., Roxbury, Vt. The frame of this machine is of cast iron, finished and nickel plated all over. It is 7" in height and the base is 4" in diameter. It is fastened to the bench, or wherever desired, by means of a single bolt.

The sliding spindle is hardened and ground to the hardened steel bushings which form the bearings. The lower end of the spindle is tapered to fit the brass sockets that carry the drills. On the top of the spindle is a hard rubber knob in which the spindle revolves, and which is used for feeding the drill to the work. Under this knob is attached one end of the long spring, which operates to return the spindle to place after it has been pressed down, as in drilling a hole. This spring is long, so that the tension will be practically constant for any position of the spindle, and only strong enough for the purpose, so that the delicacy of touch required for drilling fine holes shall not be disturbed. The cone, with two changes for belt, is made of hard rubber for the purpose of making it as light as possible, and still retain the necessary strength.

The bed plate is $\frac{1}{2}$" thick, and is finished quite flat on each of its sides. It is fastened in any desired position on the bed frame (the surface of which is made at right angles with the spindle) by means of a bolt, and a slot in the plate, the slot extending from the circumference to the center of the latter. A steel button, with screw, on the bed plate, provides for clamping the work as nearly as convenient in the required position, when by sliding the bed plate on the bed it may readily be brought to the exact position, and held firmly, thus leaving both hands free to attend to the operations of drilling, oiling, etc. Where a number of holes are to be drilled in one piece it is not necessary to loosen the work from the bed plate, as the plate, with the work attached, can be brought to the several positions required for drilling the several holes. The plate has a V groove placed across its surface for the convenience of clamping wire or irregular pieces, the pieces when so held being brought under the drill by swinging the bed plate on the bolt.

A head stock (not shown in engraving) which consists of a suitably arranged casting fitted with a spindle and rubber cone, is furnished, when required, for diamond laps, and also for drills. This head stock is attached to the frame, the bed plate being removed for that purpose, the same screw being used for attaching either. A wrench accompanies the machine, which may be used for all the screws.

The drills used with this machine are set in one end of a brass socket, the other end being reamed tapering to fit the long taper of the spindle. One end of the socket is knurled, to assist in attaching to and detaching from the spindle. For grinding long delicate drills the diamond lap is furnished. This is a steel disc about $1\frac{1}{8}$" in diameter, ground true on its face and edge and charged with emery powder. This disc is attached to a brass socket, which fits the taper of the head stock spindle.

For jeweler's use this machine can be put in place of the lathe, if the latter is run by countershaft; or it can be placed directly back of the lathe and belted from the lathe cone; or a countershaft will be furnished, which will run both the lathe and the drilling machine.

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According to Census Bulletin No 304, the number of mechanical and manufacturing establishments in the United States was 253,840 with an invested capital of $2,790,223,506. The number of persons employed was 2,738,950, whose yearly wages amounted to $947,919,647. Sixty-seven industries are reported, of which foundry and machine shop products amount to $214,331,668; Cotton goods $210,950,383; Woolen goods $160,606,721; Boots and Shoes $195,920,481. The value of the products was $5,369,667,706, which exceeded the cost of materials and labor by $1,027,398,003.

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NEW YORK, DEC. 30, 1882.

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## Our Index to Volume V.

As this issue is the last one of volume five, we include our index for the fifty-two numbers of the present year. It is somewhat longer than the index we published last December, and has the new feature of alphabetically arranging the more important topics treated in "Questions and Answers" during the year. Beginning with the first number of volume five, we have numbered the questions consecutively as they have been answered, 472 by number. In indexing they are referred to only by number, but any one having the complete volume before him will find no difficulty in using this part of the index. We have followed the rule of indexing each heading only once, as it would require too much space to place most of the headings under several different letters in the alphabetical arrangement. Those who have not a complete file for the year will find the index to the headings of every article, and "Practical Men" letters published during the year a complete guide in ordering any number in the volume containing any particular article or communication. The index of a journal which is paged continuously from the first to the last issue of the volume does not furnish such a guide. Our index (except the part relating to "Questions and Answers") *names the date of issue* in each case. Newsdealers can supply any back numbers of volume five, except the first number, upon reasonable notice.

## Suggestions and Inquiries of Correspondents.

This being the last issue of Volume V, we take occasion to treat specifically some of the topics of general or personal interest mentioned by correspondents. One writes as follows:

"There seems to be a lack of means of information on previous patents that are procurable (copies) by inventors without the formality of consulting a patent lawyer and paying a fee. To the poor inventor the fee often appears extortionate. Is there no means of communicating with the Patent Office direct for the information wanted?

"The facilities for obtaining American patents are much extolled nowadays, but there seems to be much room for improvement yet. Many a poor man is deterred from patenting useful inventions simply because of the expensive red tape required to obtain the requisite information. Many would find means to pay $60 or $75 for a patent who stand aghast at $40 expense to determine if the invention is patentable.

"I would like to ask if I can procure copies of specifications of all patents granted for improvements in any one line of machines, and the probable expense of the same."

This correspondent has probably never written for information to the Commissioner of Patents, Washington, D. C. The United States Patent Office is conducted for the benefit of the people, and any simple information would be sent free upon application, without the intervention of a lawyer or agent. For indexes to patents, patent decisions, &c., there is a moderate expense, a price-list of which will be sent from the Patent Office to any one. Single copies of patents cost 25 cents each, or twenty for two dollars. If an inventor cannot search the patent records himself, his best course is to secure the services of some thorough and experienced examiner, who can be relied upon, and who will plainly name his fees before involving any expense. It is not enough to know that an invention is patentable, the inventor should be assured that his patent specifications are properly worded, and that he has some original claim to secure. By neglecting to take these precautions the cost of a patent is often thrown away, and the inventor's time and resources wasted. If an inventor is too poor to pay the necessary expenses of a preliminary search (and cannot do it himself), his best course is to interest some party with means in his invention.

Another correspondent writes:

"I have read every number of the AMERICAN MACHINIST since it was first issued, and have always been pleased with it, and have always waited with impatience for the next number. There is something I would like to have explained to me which I do not understand. It has been noticed not only by me, but by several of my acquaintances. I know parties who have answered advertisements, appearing under head of 'Wanted,' such as 'Foreman wanted,' and have received no reply whatever from the advertisers, yet the same advertisements appear again the next week. How is this? It cannot be that letters habitually miscarry through the mails. One might, but they do not persistently lose themselves. We have noticed this omission of replies several times. Perhaps you may say business men have a right to advertise as often as they feel disposed to pay for it. No doubt they have, but common politeness should prompt them to answer any application made to them, however briefly. It may not seem much to the advertiser, but it is much to the applicant. Many a good and capable man has applied for such situations and receiving no reply, has neglected other chances, feeling somewhat bound by his application to await the answer of the advertiser."

It does not seem necessary to add much to the above. As a rule, we believe, advertisers should answer applicants. Where there are many, some neglect may have been noticed. The time and expense required to answer every one by postal card would be but little. We trust that complaints like the above will seldom arise.

Another correspondent asks the oft repeated question whether he must get a license to run a stationary engine and boiler in a country place. He can rest assured that he need not get any license. A few of the cities, especially large ones, require an engineer to be licensed. The National Association of Stationary Engineers intend to agitate for the enactment of State laws for licensing all stationary engines. In view of the many destructive boiler explosions in country places, something of this kind seems to be needed.

## "Give the Boy a Chance."

Some months since we published, under the above title, a contribution from a well-known mechanical engineer, in which the writer treated the subject from the shop standpoint, or the relations of the shopmen to the boy after the latter had entered upon, presumably, the vocation of his choice. We are reminded that there is another aspect of the boy's case, by the receipt of a letter, from which we make the following extract: "I am a farmer's son, and have always lived on the farm where I was born. My mind, however, runs to engine [locomotive] driving, but my parents have always objected, so I have a threshing machine for consolation."

There is in this a hint of what has caused, at one time or another, a good deal of harm; that is, the opposing, to an unwarrantable extent, the natural inclination of the boy with reference to his future course in life. In this particular instance, we are persuaded, from the sensible way in which our correspondent writes, that no harm is done; but we are equally persuaded that in thousands of instances opposition, carried to the extent of virtual prohibition, works irreparable wrong. To put it as a proposition, we should say: Give the boy a chance *before* he enters the shop, or upon whatever course he is to pursue—a chance, as far as possible, to elect what that course is to be.

The mistake is, perhaps, oftenest made by those who, by virtue of authority, control the actions of the boy, of not looking at the matter in its broad sense. The vocation of an engine-driver, for instance, although in every way an honorable and responsible one, has in itself nothing to especially commend it. The remuneration is not likely to be commensurate with the character and extent of the services required, and those who desire to be of the utmost service to the boy may quite naturally, but often none the less unadvisedly, allow this consideration of the subject to conclude their opinion. But this is not all there is of engine-driving. When one's vocation fails to bring to him any satisfaction further than the ability to earn a living, or even to accumulate a fortune, he is unfortunate. Furthermore, if it fails to satisfy something beyond this, it will generally fail in this. There is, to many, a compensation in engine-driving, worth more than any money consideration, and it may be accepted as a fact that no man works to the best purpose unless, in some degree, this compensation is a part of that which reconciles him and his work. It is not generally wise to insist too strongly—as beyond reasonable argument—on the "threshing machine" between the boy and what he wants to do. The chances are that it will remain there perpetually. If interposed at all, it ought to be, as it was apparently in our correspondent's experience, the result of a compromise.

Again, the engine driving, which may quite as well stand as the expression for any honest occupation, may mean to the boy's ambition more than is implied in the words that express it. It may mean to him simply one, but a necessary step towards something else, but which the inability to take that step places effectually beyond his reach. Boys, too seldom have clearly defined views of what is to satisfy them in the future, and when they do have such views, amounting to conviction, they are entitled to the utmost consideration, and the decision *not* to "give the boy a chance" should never be lightly made.

But there is another side to the subject, which in justice should be considered. Boys are not generally the most competent to judge of the probable end of a course, for which they may after all have no more than an ill-considered fancy. Lacking judgment, it is wisdom on their part to give due weight to the judgment of maturer years. The "engine driving" will be, in the majority of cases, the end of the ambition which looks at it as only the beginning. In hundreds of instances, if boys submitted philosophically to the "consolation" of the "threshing machine" it would be infinitely better for them. While boys will do well to remember that there is more of fortune and fame in almost any honest occupation than has ever been got out of it, those in authority over them are equally bound to remember that neither are likely to be come at, except by those in sympathy with what they are doing. The instances in which boys have succeeded in a course to which they were forced against a well defined contrary opinion are at most no more than sufficient to serve as exceptions to the general rule to the contrary.

We call the attention of our readers to the article on page 6, by the veteran engineer, C. W. Copeland. It may be interesting to note the fact that when this article was written the "mechanical theory of heat" was not understood or known, although it seems to be shadowed forth by the writer. It may be stated that, from observations made a few years since, Mr. Copeland formed, and still holds, the opinion that freight is transported more cheaply on the Mississippi River by the boats using high-pressure, non-condensing engines than it is in the vicinity of New York by the boats using low-pressure, condensing engines. So impressed was he at the time with this idea that he urged upon the U. S. Government the advisability of an investigation to determine the matter. Had this investigation been made—as seemed probable at one time—the knowledge gained would have been of undoubted value.

The AMERICAN MACHINIST complains of the *Mechanical Engineering* (English) and *Chicago Railway Purchasing Agent* for stealing articles and illustrations from its pages without credit. Wherefore grumble? These papers must have good articles, and know enough to pick out the best. As for not giving credit, that is something we have to complain of daily, for the contents of our *Dry Goods Bulletin* are regularly taken wholesale for other papers, and in nine cases out of ten the credit is "accidentally omitted." What an awful amount of retribution will some day weigh down some *all original publications.—Dry Goods Bulletin.*

Our experience differs from that of our contemporary as above expressed. At least in nine cases out of ten that come to our notice, articles copied from the AMERICAN MACHINIST are duly credited. Our exchanges, as a rule, are as fair in giving proper credit as could be desired. Therefore, a complaint on our part is very unusual. Journals that habitually transfer articles to

their columns without credit are hardly worth special notice.

When we published "A New Table of Indicated Horse Power" in our issue of November 25th, we did so under a misapprehension. The table was not *new*, having been published in Arthur Rigg's Treatise on the Steam Engine, and (although that was not the source from which we obtained it) should have been credited to that work. It is very seldom that we make such a mistake, but when we do, are not slow to acknowledge it.

### Literary Notes.

The Christmas number of the *American Bookseller*, just published, is an artistic gem, surpassing all former Christmas numbers we have seen. It is profusely embellished with the most tasteful and finely-executed wood engravings, selected from the whole range of illustrated books for the holidays. Any one who wishes to see the degree of perfection to which artistic wood engraving and printing has been carried, and who desires to select choice books for holiday presents, should order the Christmas number of the *American Bookseller* from his newsdealer. It is published by the American News Company.

## QUESTIONS & ANSWERS.

***Under this head we propose to answer questions sent us, pertaining to our specialty, correctly, and according to common sense methods.***

In answer to Question 461 (Dec. 23), the width of belt should have been given as 12".

(464) L. L. J., Brooklyn, N. Y., asks questions in reference to the application of pressure to water in a closed vessel, which he will find explained in any treatise on natural philosophy, to which we refer him.

(465) S. M. R., Augusta, Ga., asks: Is mercury better than water for tempering tools to turn steel? *A.*—For all ordinary purposes water is the best. Mercury is sometimes used where it is required to make a tool very hard.

(466) C. C, Philadelphia, Pa., asks: Is it true that the larger the engine the more beneficial is lead? *A.*—Only in the sense that it is of more importance to attend to such detail in the instance of a large than a small engine, because any proportion of loss from neglect will be greater in extent.

(467) S. A., Capua, Italy, asks: Will it be correct to take the motion for the drum of an indicator from a pin in the end of the crank shaft? *A.*—You can take the motion from the end of the shaft, but it will not give very correct results; that is, the reduction is not correct.

(468) H. H. B, Binghamton, N.Y., asks: Can I run the exhaust from an engine through a heater for feed-water, and then to the condenser with good results? *A.*—You can use the heater in the way suggested and make some saving over using the water from hot well for feeding the boilers. It is frequently done. Of course the heater must be tight and the exhaust passage free.

(469) J. C. B, Union City, Pa., asks: If I have two engines, each with a cylinder 13"×24" cutting off at ¼ stroke with 80 pounds steam, one running 80 and the other running 160 revolutions per minute, both doing the same amount of work, which will use the most steam? *A.*—We suppose you refer to engines with fixed cut-offs and throttling governor, in which case the one running at 160 revolutions will use the most steam.

(470) W. T. S., Salem, Ohio, writes: I have a 48" circular saw with but 14 teeth, which are so hard they cannot be swaged out without breaking. Is there any way we can soften the points of teeth without injury to the saw? *A.*—You can draw the temper of the points of the teeth by grasping them with a pair of large blacksmith tongs, previously heated to a red heat. It should not be attempted, however, except by some one skilled in tempering.

(471) R. M., Glasgow, Ky., asks: Can a water motor be used for generating electricity for illuminating purposes, instead of a steam engine? We have a water pressure of 26 pounds to the square inch. *A.*—It is quite immaterial how the power is obtained to drive a dynamo for electric lighting, the only qualification being that the power shall be very regular. If you can find a water motor that will give the necessary power and run steadily, and can furnish the water to run it cheaper than you can furnish steam power, it is the proper thing to use it.

(472) J. C. H., Nyack, N. Y., writes: I have two shafts, the one 33" inches above the other. What I want to know is: 1. If a 14" pulley on the upper shaft will drive the lower shaft with a 7" pulley? *A.*—It will not drive satisfactorily, the shafts being so near together and the difference in diameter of pulleys so great. You can probably make it drive a little. 2. Should the upper pulley be directly over the lower one? *A.*—No. For finding the position of the pulleys, see article by J. Burkitt Webb in AMERICAN MACHINIST of Aug. 12, 1882.

## BUSINESS SPECIALS.

*Transient Advertisements, 50 cts. a line for each insertion under this head. About seven words make a line. Copy should be sent to reach us not later than Wednesday for the ensuing week's issue.*


C. M. Morse, Mech. Engineer, 132 Nassau St., N.Y.

F. Samuelson, Pattern Maker, 38 Gold St., N. Y.

James W. See, Consulting Engineer, Hamilton, O.

Steel Name Stamps, &c. J. B. Roney, Lynn, Mass.

Portable Forges, $10. Holt M'f'g Co., Cleveland, O.

Presses & Dies. Ferracute Mach. Co., Bridgeton, N.J.

Latest and best books on Steam Engineering Send stamp for Catalogue. F. Keppy Bridgeport, Ct.

J M. Badger, Expert and Commission Dealer in Machinery, 5 Dey Street, New York.

J. C. Hoadley, Engineer and Expert, 28 State St., Room 28, Boston, Mass.

Wood Engraving done in best manner. Designs furnished. Edward Sears, 48 Beekman St. New York.

R. Dudgeon, 24 Columbia st., New York, Improved Hydraulic Jacks and Roller Tuoe Expanders.

Foot Power Machinery, for workshop use, sent on trial if desired. W.F. & John Barnes, Rockford, Ill.

Pattern and Brand Letters. Vanderburgh, Wells & Co., corner Fulton and Dutch streets, New York.

Lyman's Gear Chart. How to lay out teeth of gear wheels. 50 cents. E. Lyman, C.E., New Haven, Conn.

Five 18" (6 x 8 foot bed) first-class Engine Lathes ready for delivery. J. A. Fulier & Co., Worcester, Mass.

Light and fine interchangeable machinery to order. Foot and power lathes, slide rests, &c. Catalogue for stamp. Edwd O. Chase, Newark, N.J.

A lot of 25" lathes designed to equal the best Philadelphia tools, will soon be ready for delivery. Ohl & Co., E. Newark, N. J

Engine Lathes, Speed Lathes, Foot Lathes, Upright Drills, Light Drilling Machines and other fine tools, Frasse & Co., 62 Chatham St., N. Y.

Christmas Present—"The Complete Practical Machinist," by Joshua Rose, 440 pages, 196 illustrations. $2.50 postpaid. Address, P. O. Box 3306, New York City.

Boring Bars made all sizes for all purposes to bore both straight and taper work. Pedrick & Ayer, proprietors, L. B. Flanders' Machine Works, 1025 Hamilton street, Philadelphia, Pa.

Jas. F. Hotchkiss, 84 John St., N. Y.: Send me your *free* book entitled "How to Keep Boilers Clean," containing useful information for steam users and engineers. [Mention this paper.]

L. V. Conover, Iron Founder, 336 to 340 East 29th Street, New York. Heavy and Fine Castings of Iron, Brass, Composition and Copper made to order at shortest notice.

Russell & Struthers, Wax Process for making outline engravings. Specimens each week in the AMERICAN MACHINIST. We also do Map Engraving with best facilities. Russell & Struthers, 59 Park Place, New York.

Boiler Shop Tools.—Patent Bending Rolls, Boiler Plate Planers, Combined Punch and Shears, Single Punches or Shears of short or very long reach, Horizontal Flange Punches, Double or Single Bar Iron Shears, Radial Drills. Send to Hilles & Jones, Wilmington, Delaware.

The Theoretical and Practical Boiler Maker, 335 pages, and 37 lithograph plates. Published by the author, S. Nicholls, Yorkshire street, Blackpool, England. Mailed on receipt of P.O.O value $1.83, to Blackpool. See Review, AMERICAN MACHINIST, p. 8, July 22, 1882.

H. W. JOHNS' ASBESTOS AIR CHAMBER COVERING, consisting of Asbestos Sheathing or Lining Felt, combined with Hair Felt, for Steam Pipe and other heated surfaces, is patented, and infringers will be prosecuted to the full extent of the law. H. W. JOHNS M'F'G Co., 87 Maiden Lane, N Y.


## MANUFACTURES.

It is announced that three large manufactories will be built at Muncy, Pa., within a year.

The Baldwin Locomotive Works are building engines for old contracts at the rate of 11 a week.

The large new hinge factory of Oliver Bros. & Phillips, at Wood's Run, Pa, is nearing completion.

The Detroit Emery Wheel Co., have just completed an addition to their works 60x60 feet. They employ 60 workmen.

A concern at Newcastle, Ohio, is making charcoal in ovens, the yield being about 25 per cent. more than by the old plan.

The Moorehall Foundry and Machine Works at Phœnixville, Pa., which have been manufacturing machine tools, have closed.

The stove manufacturers of Troy, N. Y., asked their moulders for a reduction of 15 per cent. in wages. The men refuse to grant the request.

The Hartford Engineering Company, Hartford, Conn., expect soon to begin the manufacture of Schuyler's new electric lamp and dynamo.

The Southwark Foundry, Philadelphia, has built a Porter-Allen condensing engine (22x36 inches) for the Tremont and Suffolk mills at Lowell, Mass.

The Star Tool Company, Providence, R. I., have 100 hands at work building machine tools. They have recently made some special improvements in their machinery.

The Sullivan Machine Company, Claremont, are filling an order for $20 000 worth of machinery for the manufacture of asphalt pavement for shipment to Sydney, Australia.

The Iron City Boiler Works, Pittsburgh, Pa., are shipping a large quantity of work to Goshen, Va., for the new blast furnace being erected there by the English company.

The capacity of the Chicago Hardware Manufacturing Company's works for turning out bronze door trimmings, sash-locks, etc., is to be largely increased and new machinery added.

The Southern Steel Works is the name of a new company now forming at Chattanooga, Tenn. The company intend, when organized, to erect works at Chattanooga to manufacture fine tool steel.

The wages in the grindery at the Delaware Iron Works, New Castle, have been cut down from $12 to $7 per week. The piece workers in the cutting shop and bending mill have also had their pay reduced.

The Armington & Sims Engine Company, Providence, R. I., have orders for about 200 engines on their books and are doing their best to fill them promptly. A large portion of these are for electric lighting purposes.

The new works of the Baltimore Car Wheel Company, now in process of erection at Baltimore, will cover nearly ten acres of ground, and the establishment will have a capacity of 400 car wheels per day.

At Brilliant, W. Va., an iron foundry is about to be started with a capital of $300,000. It will have one of the best coal shafts in the country, with 26 acres of surface and 500 acres of coal lands.—*Southern Manufacturer and Builder.*

The Defiance Machine Works, Defiance, O., have published a small treatise on the art of balancing the rotary parts of machinery. It is fully illustrated and embodies facts deduced from experiments made by that company.

The Chicago, Milwaukee and St. Paul Railroad Company is erecting an extensive foundry for the manufacture of car wheels at West Milwaukee, Wis. This is an important and new enterprise, and will employ one hundred men.

S. W. Goodyear, Waterbury, Conn., writes us: "I have five machines in process of construction for reducing wire by the cold swaging process, four of them already sold. I am having many inquiries which give promise of future business."

The Pittsburgh Tool Company are about to start a machine shop in that city of the nature of the small tool manufactories of New England. They propose manufacturing reamers, twist drills, taps, dies, set and cap screws and kindred articles.

E. W. Thompson, Secretary and Superintendent of the Thomasville (Ga.) Oil Co., writes us: "We are just astonishing the natives around here with cotton seed oil. We have an immense supply of seed and everything is in successful operation."

The Chemung Hollow Ware Works, of Elmira, N. Y., is a branch of the Detroit Iron and Brass Manufacturing Co., of Detroit, Mich. At Elmira the labor of the inmates of the State Reformatory is hired for a period of five years. Two hundred and forty men are there employed,

The Diamond Emery Wheel Company, Providence, R. I., have 100 hands at work and report orders satisfactory. Their works are fitted with new tools and their products are so well liked that an increase of manufacturing capacity will be necessary at no distant date.

The shops of A. Welch, Jr., Lambertville, N. J., are full of orders for steam engines. One 18"×36" engine is now building for a Philadelphia chemical works, and several others for various parts of the country. The engine is giving excellent satisfaction wherever used.

The latest way in which it is proposed to solve the sawdust question, is to utilize the dust in the production of gas. This, it is claimed, has been successfully tried, and there are saw-mills now in Bay City, Mich., which are lighted by gas made from sawdust.

A new building, to be occupied by the Hooker-Colville Steam Pump Company, is in process of construction at the Northwest corner of Carr and Second streets. The new building will have a 50-ft frontage, a depth of 108 feet and will be three stories high.—*St. Louis Age of Steel.*

Vulcan Iron Works, Wilkesbarre, Pa., have 150 men at work principally upon running machinery. They make a specialty of direct acting hoisting engines. A pair has just been shipped to the Tamarack Mining Company in Michigan. They report business good at their works.

One hundred workmen were discharged from the Rogers Locomotive Works in one day recently, not because work was slack, but because improved machinery and appliances in the shop had rendered it unnecessary to employ as many men to accomplish the same results as formerly.

The Appleton Carriage and Sleigh Works, is the name of a new concern lately started in Appleton, Wis. The company is erecting buildings 60x80 and 25x40 feet, respectively, for manufacturing purposes, and expects to be able to begin work about Jan. 1. Forty hands will be employed.

O. Colborne is building twelve chain mortising machines for the American Chain Mortising Machine Company, this city. He is placing in his works a new shaping machine, and has just completed two 12x18-inch engines. He is running his establishment day and night.—*Chicago Industrial World.*

The Hamilton Woolen Co., Amesbury, Mass., have ordered the Curtis steam trap for their mills.

Stephen W. Baldwin, 160 Broadway, New York, has been appointed general agent for the sale of the Pennsylvania Steel Co.'s steel rails, Chas. S. Hinchman having resigned. Mr. Baldwin is also agent for sale of the same company's railroad frogs and switches, steel slabs, billets and forgings.

The American Manufacturing Co., is a new enterprise started in St. Paul, Minn. They have built a new shop and put in $3,000 worth of new machinery. Their specialties will be patented articles in iron, steel and wood, also pattern making, mechanical engineering and draughting. The members of the concern are all practical mechanics.

Benjamin, Fisher & Mallery are to build new works. The exact location has not yet been decided upon, but they will probably be on the North Side, on line of the new Evanston Railroad. The proposed machine shop is to be 60x200 feet, and one-half of the building will be two stories in height. The foundry will be 50x200, with engine room attached. The engine is to be a Corliss of 40 H. P.—*Chicago Industrial World.*

The run of the Carnegie Bros. & Co.'s Edgar Thomson "E" furnace, Pittsburgh, Pa., for the three weeks ending Nov. 11th, was 1,465 tons, 1,629 tons and 1,540 tons, respectively. This output was on 54 per cent. ore, and was made on 1 pound of coke to 1 pound of iron. Their "D" furnace has made 299 tons in one day, 1,840 tons in seven, and 7,332 tons in thirty-one consecutive days.

A rail-straightening machine has been invented by M. & F. H. Treat, of Joliet Steel Works, Joliet, Ill., for the ultimate success of which strong hopes are entertained. The rail is straightened by passing through a set of moving rollers which are ingeniously supported by the frame of the machine, so that there is very little power required to drive them.

Schaffer & Budenberg, represented by W. Heuermann, 40 John street, New York, have just received an invoice of one hundred of their new exhaust steam injectors from Germany. These injectors seem to meet with a favorable reception where they have been adopted, by effecting a considerable saving in fuel. This is accomplished by condensing a portion of the exhaust steam (used to work the injector) by which its heat is transferred to the feed water and returned to the boiler.

The A. C. & I. Machine Shops at Ashland, Ky., are enlarging and making great improvements. They have put in new shafting, new couplings, and a new engine. The new blowers have been put in, one for the foundry and one for the blacksmith shop, and the new brick sand-house is completed. They have just completed the building of a new bolt-cutting machine, and are engaged in building a new locomotive with steel boiler.—*Baltimore Manufacturers' Record.*

The skilled workmen of the Cambria Iron Co., Johnstown, Pa., have had their wages "readjusted." Some were cut down 20 per cent. and others somewhat lighter, down to a trifling reduction. Laborers are not reduced. The Pittsburgh *Gazette* says: "The officers of the company claim that the new schedule is not a reduction, but a readjustment, as by the introduction of improved machinery some of the men were enabled to increase their output without increase of labor, while other men whose labor was increased have made no more money. On the 18th inst, a similar reduction will take place in the Gautier steel works, controlled by the Cambria Iron Co."

Watts, Campbell & Co., Newark, N. J., are building a pair of engines for a cotton mill in Mexico. The cylinders are 27"×48" and 20"×48", connected to one shaft, the proportions of cylinders being in accordance with the idea of the engineer in charge. The arrangement is such that the engines can be run together, either condensing, non-condensing or compound, or either engine can be run separately, with or without the condenser. This firm are also building a pair of engines, each cylinder 32"×60", for the Mile End Thread Mill, East Newark. These engines will have a belt fly-wheel 26 feet diameter, with a 9½ foot face. They are also building on orders other sizes of engines, and a variety of special machinery, amongst which we notice a peculiar machine, building from drawings furnished for forming and tempering carriage springs.

A portion of the works of the M. C. Bullock Mfg. Co. is about completed, the part now complete being only one-half the expected size of the machine shop. The first section of the building will have a frontage of 165 feet, and a depth of 60 feet. It will be two stories and basement, with an L on one end 126 feet long. It will have a double pitch slate roof. The first floor is to be devoted to heavier tools, and for erecting heavy machinery. The pipe and bolt cutting department, and testing room for Straight-line engines, are also on this floor. The first floor will contain four heavy wrought-iron cranes, and is provided with a railroad track which passes through the shop. The blacksmith shop is situated in the rear of the L, and is to be 40x60 and will contain a powerful crane, a steam hammer, and for the present, 8 forges. An annex will be used as a wash and coat room, also for water-closets for the men. The second floor is reached by a five-ton elevator. This floor is also divided into lathe, planer, drill press and tool departments which are 30x40. The drawing room is of the same size. The pattern shop, which is in the rear of the L, is 40x60. The building will probably be ready for occupancy by the last of February 1883.—*Chicago Industrial World.*

## Machinists' and Engineers' Supplies.

NEW YORK, Dec. 14, 1882.

During the past week the volume of business in machine tools and supplies has increased remarkably considering the season. It is probably due to the fact that present evidences indicate that the tariff will possibly be not greatly changed for next twelve months. This, together with the restoration of confidence among the steel manufacturers and consumers, has had the effect of creating a belief that the first of the new year will witness a marked increase in business with a correspondingly large consumption.

The Cope & Maxwell Manufacturing Co., Hamilton, O., have just issued the 17th annual catalogue of their pumping engines, steam pumps and hydraulic machinery. This catalogue contains 81 pages of illustrated descriptions of pumps and pumping machinery with important details named and numbered. The book is well indexed and clearly printed. The engravings are neatly executed.

Rubber goods, such as belting and packing, have recently advanced ten per cent. owing to the high price of raw material.

J. S. Follansbee, Bridgeport, Conn., is manufacturing a new covered slide rest for brass finishers use in which all screws are protected from dirt, the tool post being adjustable.

## Iron and Metal Review.

Owing to the recent acceptance of orders at lower bids, there has been a slight increase during the week of business in the Pig Iron market, but the transactions are confined chiefly to small orders for immediate wants. The unsettled state of the market causes buyers to hesitate in ordering, and still view the future with apprehension.

We quote prices as follows: Foundry No. 1, $25.50 to $26. Foundry, No. 2, X, $23 to $24. Grey Forge, $20 to $21. Foreign iron continues in light demand with slightly easier prices in view of a reduction in ocean freights for January.

We quote Coltness $26 to $26.75; Glengarnock, $23 to $24; Gartsherrie, $25.50 to $26; Summerlee, $25.50 to $26.; Carnbroe, $23.; Eglinton, $22 to $22.50; Langloan, $26 to $26.50. Wrought Iron Scrap nominal at $28 to 28.50 from Yard. Manufactured Bar Iron has fluctuated somewhat, but the present card rate is $2.40 to $2.50.

Copper is in moderate demand, at 18c. to 18¼c. Banca Tin 28c.; Straits and Malacca 21⅜c. to 21½c.; Billiton 21¾c.; Australian 21¼c. English Lamb and Flag 21¾c.; English Refined 21½c.; Spelter, Common, Domestic, 4.90c. to 5½c.; Refined 8c. to 8¾c.

Lead, 4.55c. to 4.70c.; Antimony, Cookson's, 12c. to 12½c.; Hallett's, 10⅝c.; Nevada, 12c.

## WANTED

*"Situation and Help" Advertisements, 30 cents for each seven words (one line) each insertion. Copy should be sent to reach us not later than Thursday morning for the ensuing week's issue.*

Mechanical Draughtsman. Best references, wants engagement. Hufnagel, 64 Nassau st., N. Y. City.

Wanted Machinists.—A few strictly first-class vise hands or fitters, accustomed to fitting up machines. Liberal wages to the right men. Apply immediately to Niles Tool Works, Hamilton, Ohio.

Wanted—A good, steady man that has had experience in working and putting up Heating Furnaces for working Scrap Iron. Address, Frick & Co., Waynesboro, Franklin Co., Pa.

Wanted—General machinists and tool makers, also a good tool blacksmith to work on dies. Inquire Lalance & Grosjean M'f'g Co., Woodhaven, L. I., near East New York.

Wanted—Foreman fully competent to take charge of 20 to 30 men in a brass foundry, and make good work. Must be first-class. Address, Factory, care AMERICAN MACHINIST.

Machinist Blacksmith, who is competent to take charge of a steam boiler when not employed at his fire, can find a steady situation in a machine shop in this city. Address, giving age and experience, N. Y. City, AMERICAN MACHINIST office.

Steam Users in want of First-Class Licensed Engineers can be supplied with reliable men. Address, Benj. F. Kelly, No. 20 Cortlandt St., New York. Agent for James Jenks' Duplex Injector and The Baragwanath Steam Jacket Feed Water Heater and Purifier.

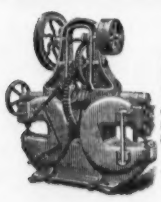
Wanted situation as Foreman or Superintendent by a good mechanic at present in responsible charge of 100 men. Desires to change for special reasons. Accustomed to fine work. Can design and construct. Best references. Address, Master Mechanic, care AMERICAN MACHINIST.

Wanted—an appointment as Superintendent, Chief Draughtsman or Chief Engineer in a large manufactory, by a gentleman from England; a thoroughly practical Mechanical Engineer, of strict business habits, accustomed to carrying out first-class work, well up in designing, estimating, &c., age 31. "England," office of the AM. MACHINIST.

An active, pushing mechanic, with eighteen years' experience, who thoroughly understands his business, desires an engagement. Experienced in designing and constructing machinery and tools, and the management of men. Strictly sober and reliable, with unexceptionable references. Address, BOX 6, care AMERICAN MACHINIST.

Competent Superintendent wanted for a new and well appointed Malleable Iron Works, doing all kinds of work such as usually done in machine shops, malleable and gray iron works. Must understand thoroughly the mixing of irons, annealing, pattern making, core making, etc., and be able to take charge of all departments, each having a competent foreman. Address, Iron, care AMERICAN MACHINIST.

Large tools wanted—30 ft. Pit lathe, also large planer 6 or 7 ft. square, to plane at least 24 ft. Send prices and quickest delivery, M. C. Bullock Manufacturing Co., 80 to 88 Market St., Chicago, Ill.

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Dealers in
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Is the Best in the market. Send for our prices before ordering Engines, Boilers, or other machinery.
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BUILDERS OF FIRST-CLASS
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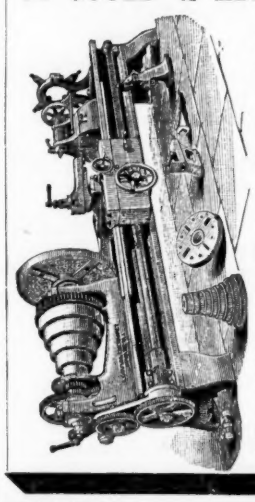

American Foundry Practice.
PUBLISHED THIS DAY. (NOV. 18.)
AMERICAN FOUNDRY PRACTICE.—Treating of Loam, Dry Sand and Green Sand Moulding, and Containing a Practical Treatise upon the Management of CUPOLAS and the MELTING OF IRON. By Thomas D. West, practical iron moulder and foundry foreman. Fully illustrated. 12mo, cl., $2.50.
"This volume is the result of many years practice both as a workingman and a manager of foundries."
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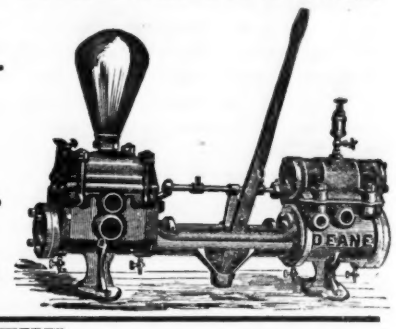


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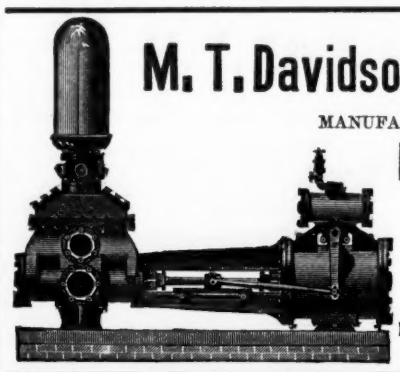

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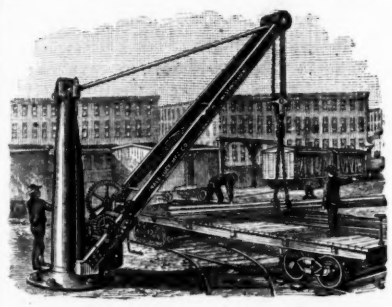

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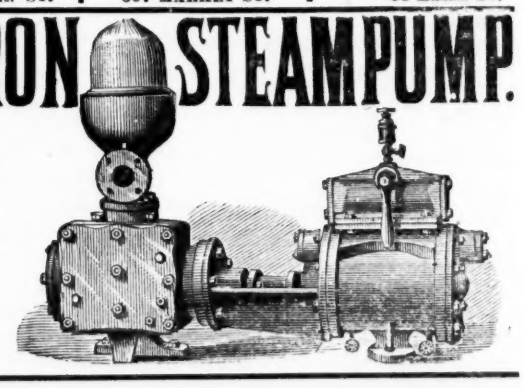

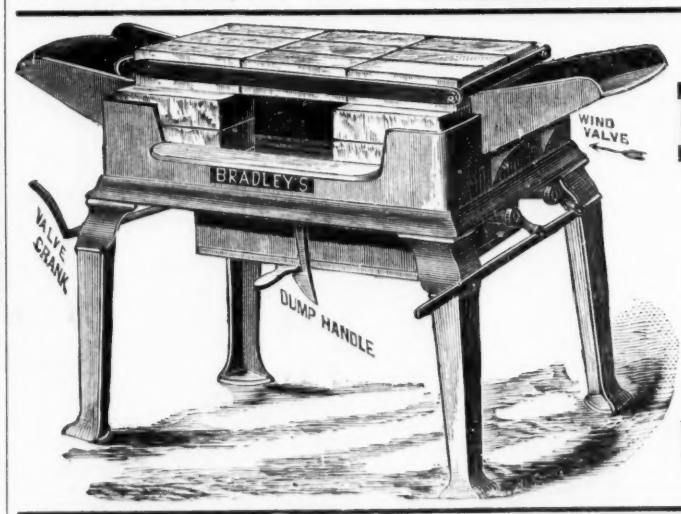


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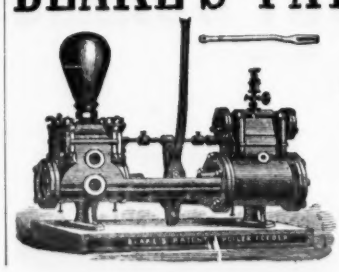

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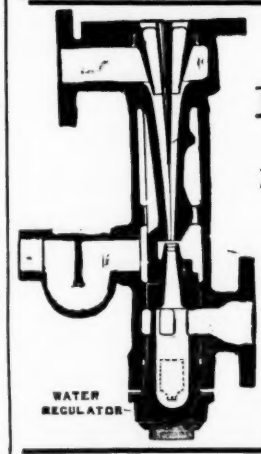

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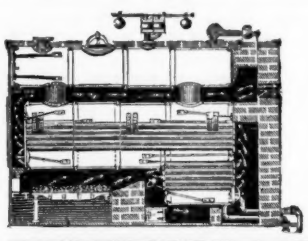

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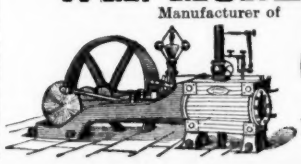

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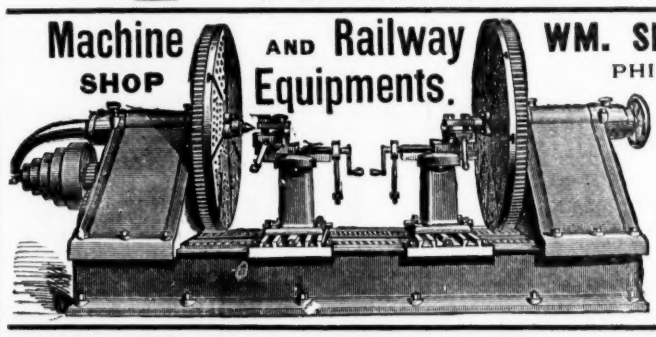

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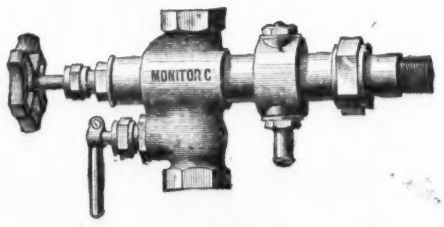


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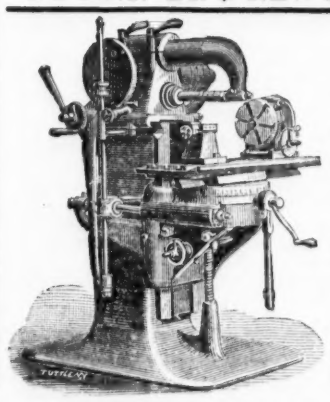

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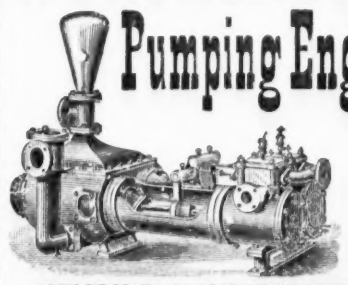

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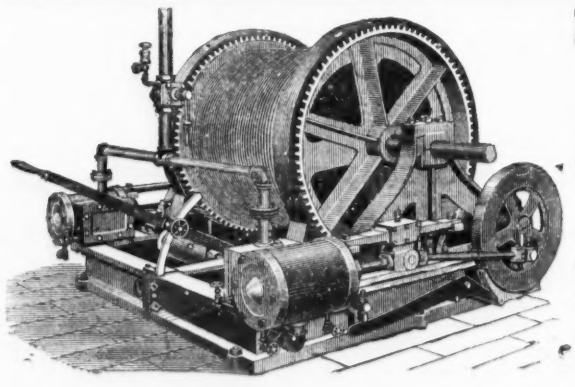

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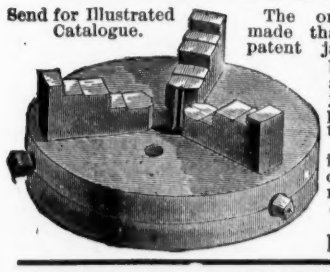

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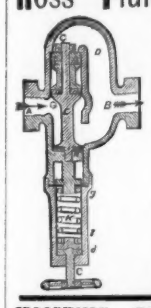

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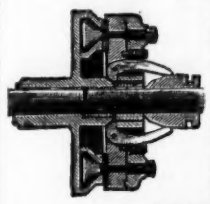

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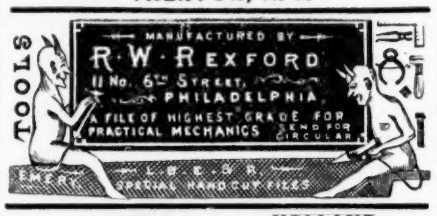

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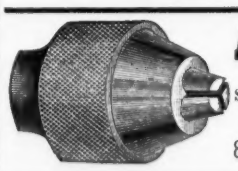

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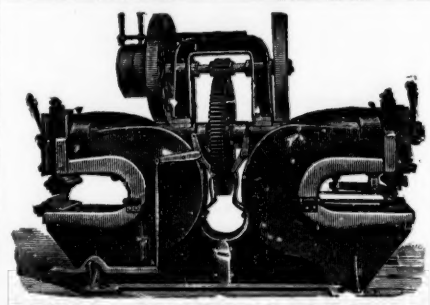

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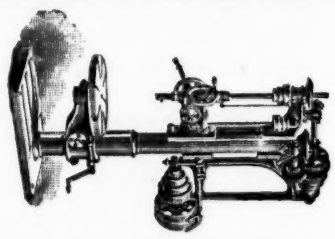

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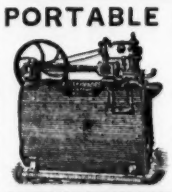

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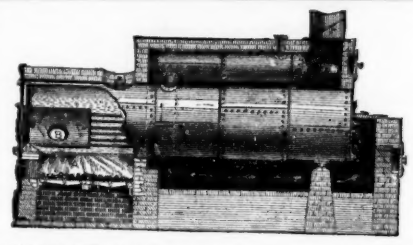

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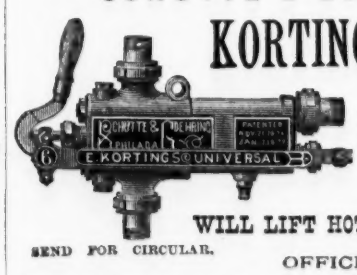


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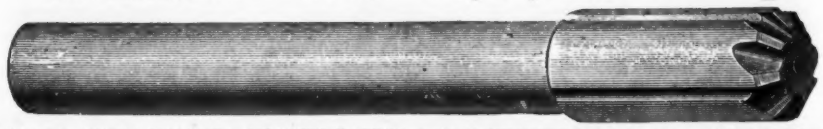

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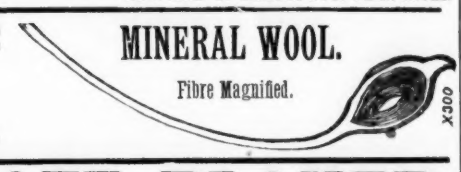

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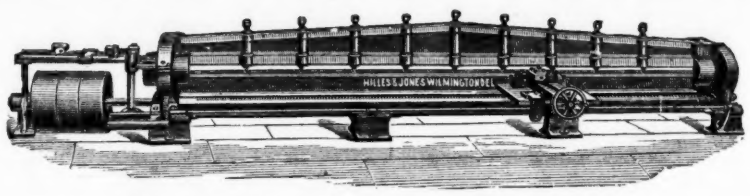

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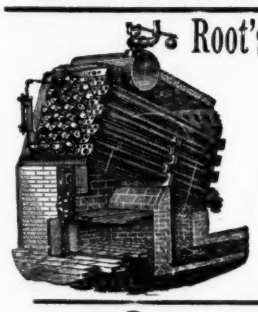

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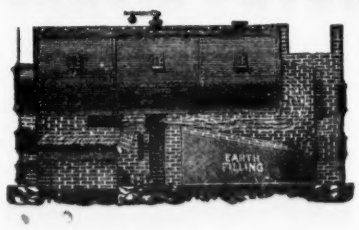

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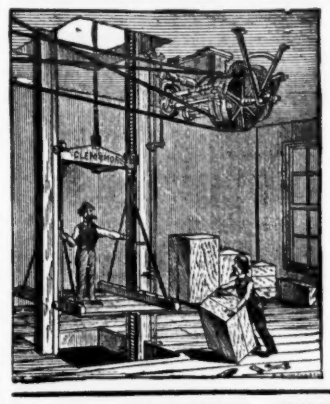

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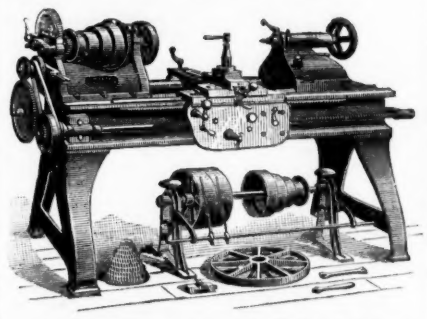

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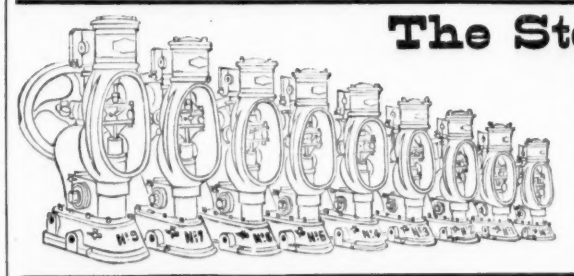

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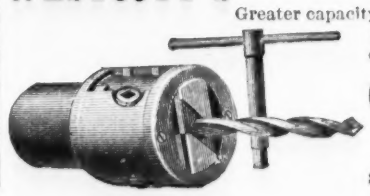

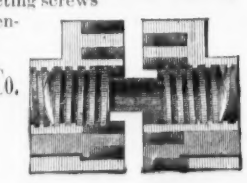

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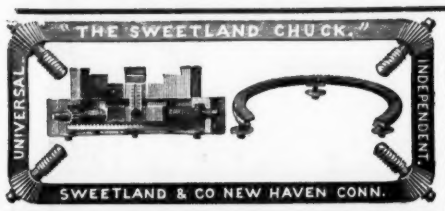


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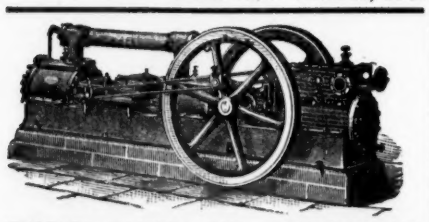

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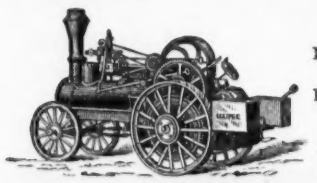

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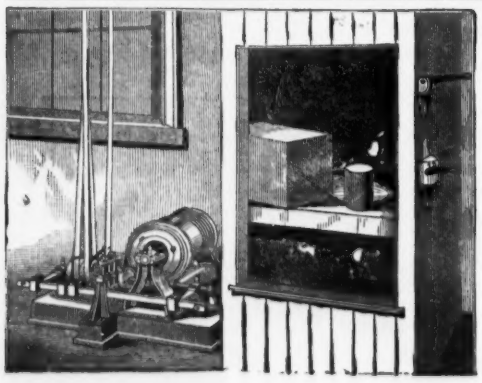

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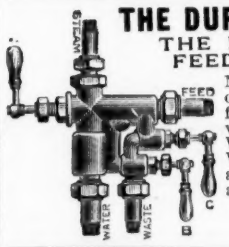


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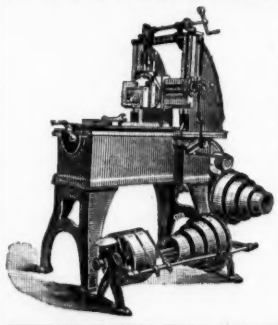

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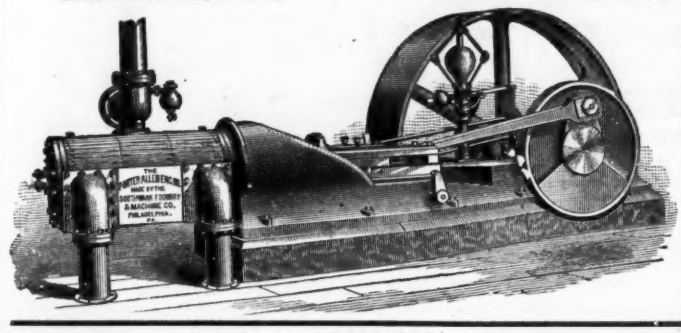

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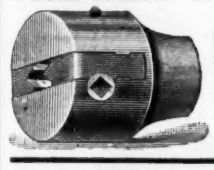

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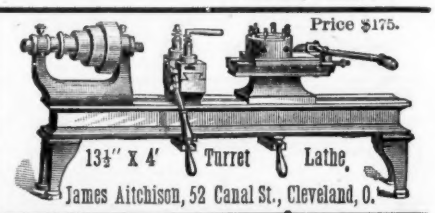

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ENGINE LATHES, HAND LATHES, Foot Power Lathes, Slide Rests, &c.

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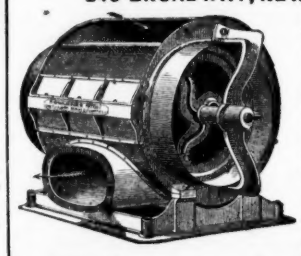

Has no equal for a Pressure Blast.

Gives a definite quantity of Air without reference to condition of Cupola.

Speed and Power Less than for any other blower.

**Will give any required Pressure.**

At 50 to 100 Revolutions per minute.

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Warranted superior to any other make.

All sizes and styles for every class of work.

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## KORTING CONDENSER.

For Steam Engines and Pumps.

Requires no Air Pump and no foundations. Only 15 ft. height of water required from level of water supply to discharge pipe, instead of 34 ft., whether above or below engine cylinder. Has fewer parts, and is lower in price than any other condenser. Send for circular giving full information.

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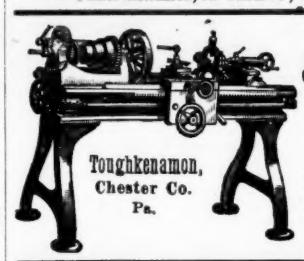

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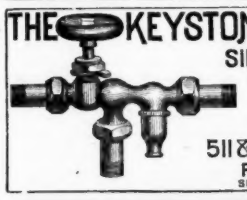
## THE KEYSTONE INJECTOR



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SAFETY! ECONOMY! CONVENIENCE!

Expense Ceases when Engine is Stopped.

When power is required at intervals it is the cheapest Motor known.

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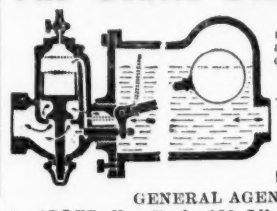

Send for Circular stating advantages and superiority over other traps.

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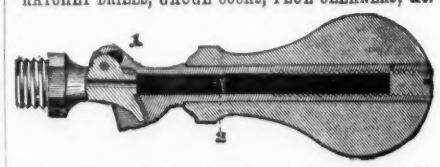


Each Gauge Cock has four inches of Jenkins' Packing. One packing will last several years.

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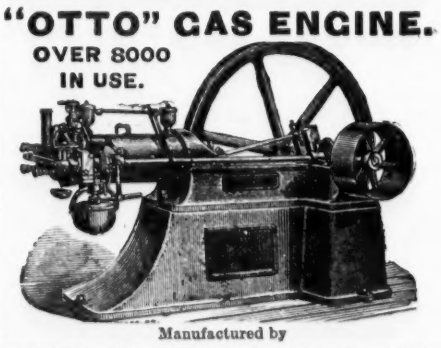

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Built for **Heavy and Continuous Work**, and adapted to **any required speed**

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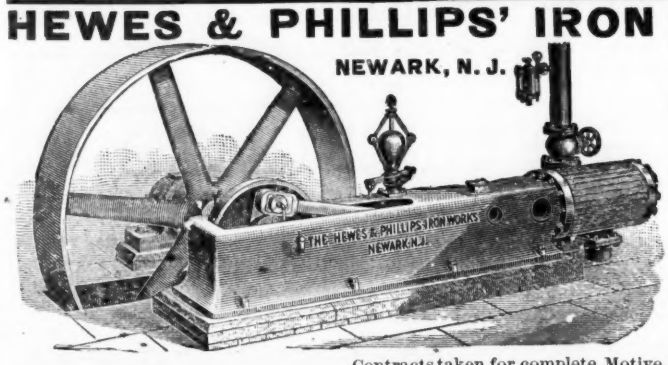


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Both Condensing and Non-Condensing. High economic duty and fine regulation guaranteed.

**Tubular Boilers and Steam Fittings.**

Contracts taken for complete Motive Power Outfits.

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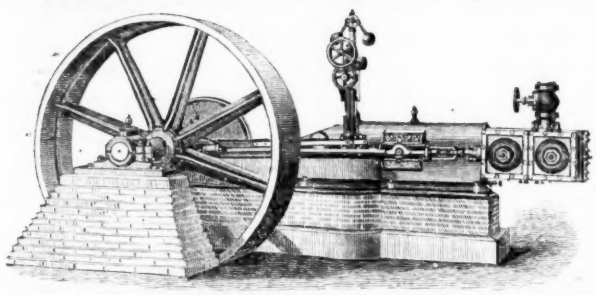

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Steam Engines

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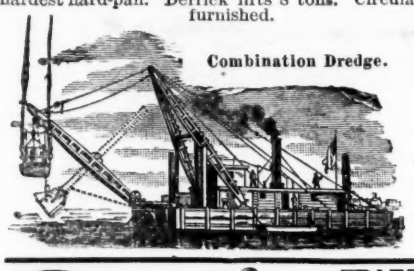
**DREDGES**

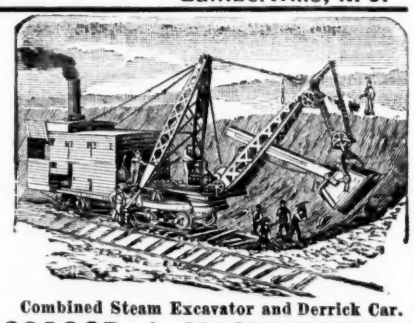
guaranteed to excavate 50 per cent. more material from hard bottom than any other machine.

**EXCAVATOR**

has a capacity of 4 cubic yards per minute in gravel. Has proved very efficient and desirable in the hardest hard-pan. Derrick lifts 8 tons. Circulars furnished.



**Combination Dredge.**



**Combined Steam Excavator and Derrick Car.**

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**ALBANY, N. Y., Patentees,**

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**PATENT RATCHET SCREW-DRIVER.**

Price per set, one handle and three blades, drop forged tool steel, $3.00 All goods warranted. Send for Circular. Address: **Rhodes & Hays**, P. O. Box 25, Hartford, Conn.

New and Second-Hand Iron Working

## MACHINERY.

One **Engine Lathe**, 42 in. x 16 ft. Triple Geared. Ames. New.
One Engine Lathe, 36 in. x 18 ft. Fifield, New.
One " " 28 in. x 16 ft. Ames. "
One " " 30 in. x 14 ft. " "
Two Engine Lathes, each 24 in. 8 ft. x 10 ft.-12 ft.-14 ft. and 20 ft. New. Ames.
Two Engine Lathes, 24 in. x 10 & 12 ft. Fifield.
One Engine Lathe, 20 in. x 12 ft. Ames, New.
One " " 20 in. x 10 ft. " "
One " " 20 in. x 8 ft. " "
One " " 20 in. x 10 ft. Jones & Lamson. New.
One Engine Lathe, 16 in. x 6-7-8-10-12 ft. Bridgeport Mch. Tool Works. New.
Six Engine Lathes, 16 in. x 6 ft.-7 ft. x 8 ft. Ames. New.
One Engine Lathe, 14 in. x 6 ft. Star Tool Co. New.
Two Engine Lathes, 13 in. x 5 ft. Ames. New.
Three Hand Lathes, 12 in. x 5 ft. Hendey. New.
Two Pulley Turning Machines, 26 in. & 36 in. New.
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Two Planers, 26 in. x 7 ft. New.
One " 27 in. x 6-7-8 ft. Ames. New.
One " 28 in. x 6 ft. Gleason. New.
One 6 in. Stroke Shaper. Boynton. New.
Two 9 in. Stroke Shapers. Hewes & Phillips.
One 15 in. Stroke Shaper. Hendey. New.
One 15 inch Stroke Shaper. Gould & Eberhardt. New.
One 24 in. Stroke Shaper. Hendey. New.
One Screw Machine. No. 2. P. & W.
One Screw Machine. No. 3. P. & W.
One Screw Machine. New Pattern. Wire Feed. Secor.
Three 4 Spindle Drills. No. 2. Pratt & Whitney.
One 6 " " No. 1. " "
One 20 in. Upright Drill. Prentiss. New.
One 24 in. Upright Drill. Prentiss. New.
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Three Sensitive Drills.
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Two Lincoln Pattern Millers. Pratt & Whitney. Good
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One 60 lb. Bradley Hammer. New.
All sizes Bradley Hammers furnished to order promptly.

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1 90 inch Swing, 20 foot Bed, Engine Lathe. 2d hand.
1 43 " 14 " " New
1 36 " 20 " " "
1 36 " 22½ " " "
1 25 " 20 & 16 " " "
Lot other sizes, both new and second-hand.
1 Iron Planer, 36 inch x 36 inch x 13 feet. New.
1 " " 36 " 36 " 11 " "
1 " " 36 " 36 " 9 " "
1 " " 36 " 36 " 9 " Nearly New
1 " " 32 " 32 " 9 " "
1 " " 24 " 24 " 6 " New.
Lot other sizes, new and second-hand.
1 60 inch Upright Drill. Second-hand.
1 2½ inch Cutting-off Machine. New.
1 each, 40 inch and 48 inch Radial Drills, New.
1 50 inch Horizontal Boring Mill. New.
1 12 inch Stroke Slotter. New.
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*Send for Circular of other tools.*

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Machinists' Power Tools & Supplies.

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**One Fitchburg, Triple Geared, Screw Cutting Engine Lathe, 50 inch swing, 20 foot bed.**

**One Special Shafting Lathe, 26 inch swing, 25½ foot bed, to take 20 feet between centers.**

MACHINE TOOLS

now on exhibition at New England Manufacturers' and Mechanics' Institute,

Will be sold at very low prices

TO SAVE EXPENSE OF REMOVAL.

Send for List and state what Tools you want.

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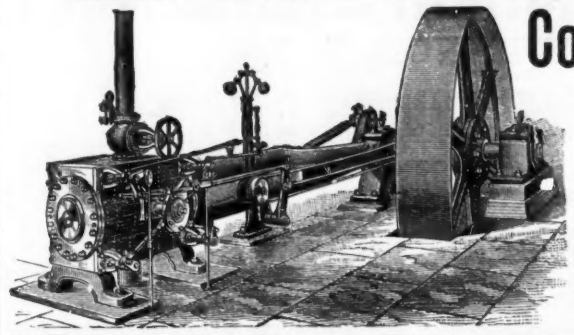

Corliss Engine Builders,

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HIGHEST EFFICIENCY AND GREATEST ECONOMY.

Boiler Makers.

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## FOR SALE.

4 New Cylinder Boilers 36" diam. x 30' long each, with fittings and fixtures complete, including 1 Steam Drum 24" diam. x 13' long; 1 Mud Drum 20" diam. x 16' 6" long.

ALSO,

3 New Stationary 2 Flue Boilers, 42" diam. x 30' long, Flues 14" diam., with complete fixtures and fittings, including 1 Steam Drum 24" diam. x 12' long. Breeching, Stack, Etc.

*Full Specifications, with drawings, will be furnished upon application.*

**Stearns' M'f'g Company,**
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**PROMPT DELIVERY.**

One 12 inch Cylinder. 36 inch Stroke. At once.
One 14 " 36 " In two weeks.

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## New & Second-Hand Machinery.

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1 Engine Lathe, 14 in. x 5, 6 & 7 ft. Grant & Bogert.
1 " " 26 in. x 12 ft. Grant & Bogert. [New.
1 " " 22 in. x 14 ft. " " New.
1 " " 36 in. x 12, 17 ft. New.
1 " " 42 in. x 14 ft. New.
1 " " 32 in. x 8 ft. " "
1 " " 21 in. x 7 ft. " " Pond.
1 " " 14 in. x 6 ft. Star Tool Co. New.
1 " " 15 in. x 6 ft. "
1 " " 14 in. x 5 x 6 ft. "
1 " " 16 in. x 6, 7 & 8 ft. Bridgeport. "
1 " " 13 in. x 5 ft. & 6 ft. Ames. "
1 " " 16 in. x6, 7 & 8 ft. Ames. "
1 " " 18 in. x8 & 10 ft. Lodge & Barker "
1 " " 27 in. x 10 in. Lodge & Barker.
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1 " " 28 in. x 16 ft. New. Fifield.
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1 28 in. " " " " " "
1 15 in. Shaper. Gould & Eberhardt. "
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1 9 in. Shaper. New.
Full assortment Milling Machines, Spindle Drills, &c., of Garvin's. New.
1 Schlenker Bolt Cutter to take sizes from ¼ to 1¼ inches inclusive. New.
2 No. 2 Lincoln Millers. Good order
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1 Upright Boring and Chucking Mill 31 in. swing. A1 order.
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## BIRKENHEAD'S NEW SINGLE HEAD LATHES

Hollow Spindle, Improved Stop Motion, 14 in. Swing 4 to 8 feet beds. Send for Circular.

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The Most Perfect Goverpor Known.

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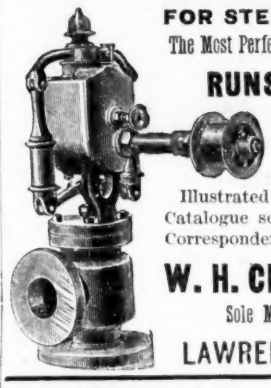

Guaranteed to accurately regulate all classes of engines.

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**The following New and Improved Machinists Tools are part of what we have for early delivery**

1 60 in. swing 24 ft. bed. Engine Lathe. Dec. 1.
1 42 in. " 20 ft. " " " " 1.
1 36 in. " 18 ft. " " " " 15.
1 36 in. " 14 ft. " " " " 15.

**The following on hand:**

1 New Corliss Engine. 12" x 36". Complete.
1 42 in. swing, 16 ft. bed, New Engine Lathe.
1 30 in. " 18 ft. " " " "
1 30 in. " 16 ft. " " " "
1 30 in. " 14 ft. " " " "
2 22 in. " 12 ft. " " " "
4 18 in. " 8 ft. " " " "
5 15 in. " 6 ft. " " " "
1 10 in. " 5 ft. " " " "
1 30 in. " 12½ ft. " " " "
1 26 in. swing, 14 ft. bed. " " "
1 12 in. swing, 6 ft. Hand Lathe. New.
1 10 in. " 4½ ft. Bed Hand Lathe. New.
1 38 in. x 12 ft. Iron Planer. New.
1 38 in. x 10 ft. " " "
1 32 in. x 8 ft. " " "
1 26 in. x 6 ft. " " "
2 30 in. x 8 ft. " Planers. "
2 22 in. x 4 ft. " " "
2 38 in. Swing Upright Drills. B. G. & S. F. New.
1 23 in. Drill. B. G. & S. F. New.
1 22 in. " Upright Drill. B. G. S. F. New.
1 23 in. " Plain.
3 20 in. " "
18 in. Bench Drill.
1 4 spindle Drill. New.
1 3 " " "
2 4 " " Second-hand.
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2 15 in. " "
2 12 in. stroke Shapers, traveling head, 40 in. traverse double tables. New.
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1 Pond's Double Milling Machine. 2d-hand.
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1 Screw Head Slotter. Second-hand.
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1 Foot Punch, with bench. New.
1 Lot Pistol Machinery. Second-hand.
Lot of Forges 1 Railway Saw Bench, 1 Foot-power Circular Saw.
Cold Rolled Shafting, Pulleys, Hangers, Couplings, &c., always in stock.

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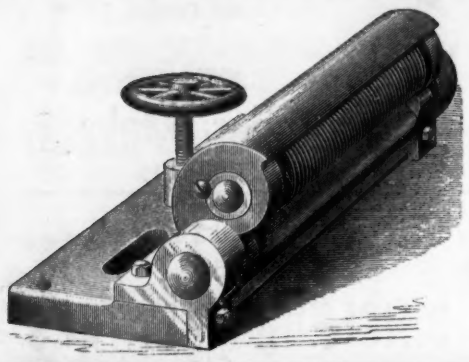
# BROWN & SHARPE MFG. CO.

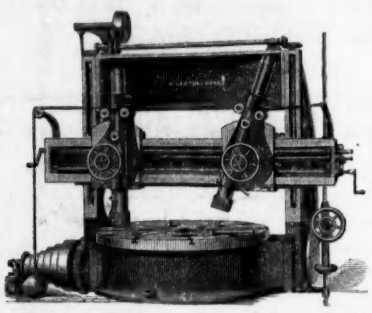
PROVIDENCE, R. I.

## GRINDSTONE TRUING DEVICE.



One of the most disagreeable things to be done in a workshop is the Truing of Grindstones. It is, therefore, often the case that they are allowed to become quite out of shape and untrue, very much to the annoyance of the workman, who finds it almost impossible to grind his tools in a proper manner. The above cut illustrates a device which is well adapted for truing and keeping the face of grindstones constantly in good shape. This can be instantly applied to the face of the stone, working automatically, without interfering with the constant use of the stone, and does the truing without raising any dust

# BORING AND TURNING MILLS



5, 6, 7, 8, 10, 12, 14 and 16

FEET SWING.

**The Pray Mfg. Co.**, reports—"Can bore and turn **a Pulley 8 feet diameter, 26 inch face,** trim the edges and face the hub in 8 *hours*. Handling included."

**Buckeye Engine Co.**—"Can bore and turn **a Pulley 12 feet diameter, 27 inch face, in 17 hours**, including handling."

**Porter Manfg. Co.**—"We are using your mill for **boring cylinders,** and find it does **quicker work and more accurate than any Lathe. Cylinders bored** on this machine are **absolutely perfect,** as near as we can measure.

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**PRATT & LETCHWORTH, Proprietors.**

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## ENGINE LATHES

FROM 16 to 48 IN. SWING.

Cuts, Photographs and Prices furnished on application.

Lowell, Mass, U. S. A.

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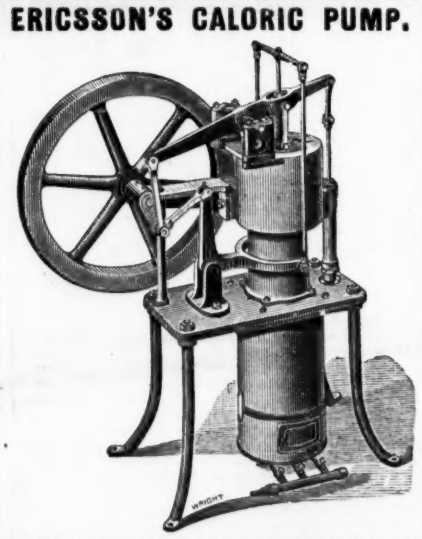
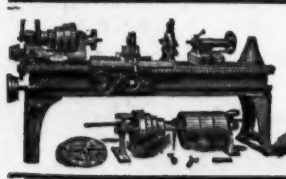


C. H. DELAMATER & CO., 10 Cortlandt Street, New York.



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Built to Standard Gauges and Templates, with Special Machinery.

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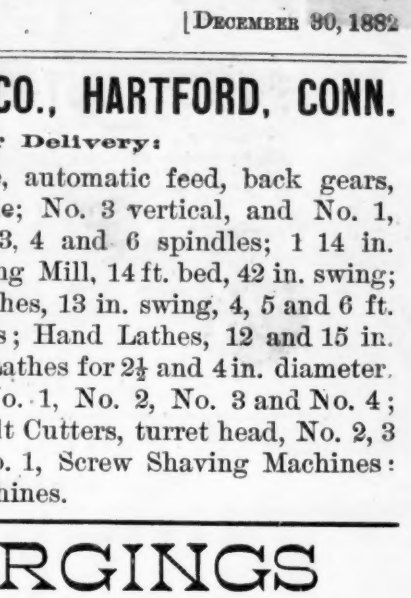

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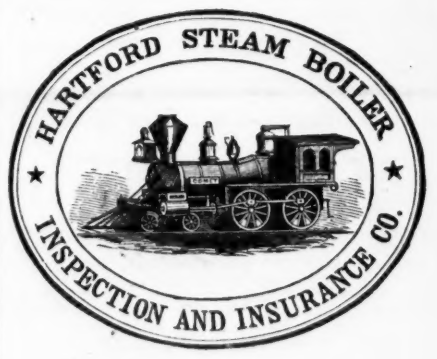


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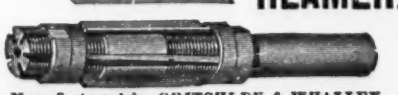

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